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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

First Annual Meeting of the Michigan Gas Association.

THE MICHIGAN GAS ASSOCIATION,
SAGINAW, MICH., Feb. 5, 1894.

The first annual meeting of the Michigan Gas Association will be held at Grand Rapids, on Wednesday, February 21.

The meeting will be called to order at 8:30 in the morning.

A list of the papers to be read will be published later.

HENRY H. HYDE, Secretary.

[OFFICIAL NOTICE.]

Twenty-Fourth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY, LYNN, MASS., Jan. 18, 1894.

The twenty-fourth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21st and 22d. The meeting will be called to order at 10 o'clock, Wednesday morning.

A general invitation is extended to members to contribute to the interest of the meeting by papers or questions for the Question Box.

A list of the papers and questions to be considered will be published later.

C. F. PRICHARD, Secretary.

BRIEFLY TOLD.

THE NEW ENGLAND ASSOCIATION MEETING.—In something over a week two of the Associations will be in session, busily engaged in promoting, to the best of the ability of their respective members, the interests of the profession which has benefited so greatly by similar action in the past, and which will benefit as greatly by efforts that are to be made on like lines. While we have not heard in detail from Secretary Prichard as to the arrangements for the meeting of the New England Association, either in the instance of the literary portion of the proceedings or the entertainment that is to be provided, we can nevertheless say that the outlook for papers is quite good. In fact, the likelihood in this respect is quite to the mark that the paper list will not suffer by comparison with any other in the Mother Association's history. President Nettleton, of course, will in his inaugural message have much to say of interest, and that he can put it in methodical, easy fashion requires no averment from us. Then, too, the Committee appointed to investigate the effect of the trolley system on gas and water pipes may be counted on with confidence to have something of moment to report. As to the entertainment portion of the meeting, we have only to say that the proverbial New England hospitality is still as forceful and potent as ever, wherefore, imagining in regard to that feature is certain to be borne out by that which the Association shall provide. The meeting also ought to be more than welcomed by those who in season and out proclaimed the possibility of dollar gas; for this time they can congratulate each other upon the attainment of what seemed an impossibility in New England 20 years ago—the dollar rate in more than one New England city.

THE MICHIGAN YOUNGSTER MAKES ITS BOW.—From the West, too, comes the warning note that another Richmond is in the field, ready to do battle for the cause of gas, for in our official announcements will be found the call from Secretary Hyde to attend the first annual meeting of the Michigan Gas Association, which is set for February 21st at Grand Rapids. Secretary Hyde's notice shows that the Michigan boys are not afraid to begin early, for no doubt all will agree that 8:30 A. M. is not an hour that laggards favor. However, it is not the hour but the date of the meeting (Feb. 21st) that staggers the JOURNAL. This day is the one on which the New England Association will convene, and the real difficulty is the distance between Boston and Grand Rapids, a dis-

tance that obliges even newspaper men to admit their inability to compass it in 24 hours, so far as actual bodily presence is concerned. In the spirit, of course, the thing is easy enough. Seriously, however, there are many who would like to attend the session of each Association, and perhaps the Michigan may eventually see its way clear to setting its meeting time forward to a date that will end all clash. We shall look with interest for the promised list of papers, and have no doubt that the Association will be vigorous and fruitful.

GAS RATES IN NEW YORK.—Again is the gas interest of New York threatened by the ever-itching palms of the legislators, whose chief business in Albany seems to be the despoiling of corporations, without any regard to fairness of purpose or honesty of motive. Indeed, this year the legislative desire to cut gas rates in the larger cities is particularly rampant, since no less than four bills of that character have been introduced. One of the measures, which seeks to put the gas rate in the annexed district at $1.25 per 1,000, has secured the partial consent of the Assembly at the present time of writing, and there is very good reason for believing that it will ultimately become a law, although there does not seem to be any cause for its passage. Certainly, there has been no public outcry for "relief" of the nature proposed, and in any event the strife between the Companies immediately north and east of the Harlem river and the Standard Company, the works of which are south of that river, in New York city proper, has virtually resulted in the establishing of the $1.25 rate in the most thickly settled portion of the annexed district. The city itself has admitted that gas rates in what for convenience may be termed the Westchester end of the city, should be higher than in New York proper, since it authorizes the payment of a very much higher price per annum for street lighting in the annexed district than is paid for a similar service south of the Harlem; nor does it need any argument to prove that it should be so arranged, for the difference in the gas supply of the two districts is very much like the difference that exists between wholesaling and retailing. In any event, apart from any of the conditions which govern the supply of gas in the annexed district, the absence of any demand, concerted or otherwise, on the part of the people of that territory, for cheaper gas, is proof that what is known as the Marrin bill is either of the "strike" or demagogic order. The other bills, which seek to in effect put the price of gas at $1 per 1,000 in the cities of New York and Brooklyn, are simple types of vicious legislation; and we venture to say that none would be more chagrined at their eventual enactment than the legislators who introduced them. They have not been presented in good faith, and the chances are they will not be passed this year. How they will be strangled can best be explained by the parties who concocted them. The richest gas in the world is supplied right here in New York City, and at $1.25 per 1,000 cubic feet it is easily able to hold its own against any other means of artificial illumination, wherefore it would seem that the law of supply and demand—making proper regard of the relative values of the different lighting agents within the reach of the people—ought to determine what gas is worth, in New York City, to the user thereof. In any event, we hold now, as we always have held, that the Legislature of this State has no constitutional right to say what a Gas Company organized under the general law may or may not charge for its product. Further, if the right to regulate gas prices exists in any authority, it exists in the local and not the State authority.

NOTES.—During January the consumption of gas in Wheeling, W. Va., amounted to 15,296,000 cubic feet.——On May 1, 1894, the Consumers Gas Company, of Reading, Pa., will reduce its selling rate to $1.50 per 1,000 cubic feet.——The holder of the Canisteo (N. Y.) Gas and Electric Company was early this month overturned during a severe gale.——At the annual meeting of the Niagara Falls (N. Y.) Gas Light Company the following officers were chosen: Directors, H. L. Brewster, A. E. Perkins, G. N. Perkins, H. Hawks, L. A. Boore, L.W. Pettibone and P. A. Porter; President, H. L. Brewster; Vice-President, P. A. Porter; Treasurer, A. E. Perkins; Secretary, L. A. Boore.

[Prepared for the JOURNAL.]

Gas Combustion and Temperatures.

By "J. P. G."

As gas comes into more general use for fuel for different purposes, it seems desirable that there should be a short but yet practically correct method or rule of estimating the heating values of the different kinds and qualities. The following has been found convenient and practically accurate.

Primarily, tables should be made of the heat units of the proximate elements of the gas to be used for heating purposes; of the several products of combustion per unit or pound, which will vary with the quantity of air used and of their specific heats, with the products of the multiplication of the products of combustion by their specific heats; of the weights of 1,000 cubic feet of the gases; and of the weights of the ultimate elements.

TABLE 1.

Gas.	Symbol.	Heat Units.	Heat Units when Products of Combustion are above 212°.
Hydrogen	H	62,030	53,330
Light carbureted hydrogen or methane	H_4C	24,240	22,065
Heavy carbureted hydrogen, or ethene	H_4C_2	22,180	20,940
Butylene	H_8C_4	22,180	20,940
Acetylene	H_2C_2	....	....
Carbonic oxide	CO	4,400	....
Sulphureted hydrogen	H_2S	8,057	7,545
Nitrogen	N	0	....
Carbonic acid	CO_2	0	....
Ammonia	H_3N	10,908	9,374

TABLE 2.—*Products of Combustion and Their Specific Heats.*

Products.	Symbol.	Pounds per Unit.	Specific Heat.	Pounds × by Sp. Heat.
Aqueous vapor	H_2O	9	.4805	4.3245
Carbonic acid	CO_2	3⅔	.2169	.7953
Nitrogen	N	..	.2438	....
Sulphurous oxide	SO_2	2	.1540	.3080

TABLE 3.—*Weights of* 1,000 *Cubic Feet of the Proximate Elements.*

Gas.	Symbol.	Specific Gravity.	Weight in Pounds of 1,000 Cu. Ft.
Hydrogen	H	.0693	5.594
Light carbureted hydrogen	H_4C	.556	44.75
Heavy carbureted hydrogen	H_4C_2	.973	78.30
Butylene	H_8C_4	1.946	156.6
Acetylene	H_2C_2	.92	74.3
Carbonic oxide	CO	.973	78.3
Sulphureted hydrogen	H_2S	1.174	94.8
Nitrogen	N	.973	78.3
Aqueous vapor	H_2O	.625	50.346
Carbonic acid	CO_2	1.524	123.043
Ammonia	H_3N	.591	47.71
Carbon	C	.834	67.12

TABLE 4.—*Of the Proximate Elements and their Atomic Weights.*

Atomic weight of H = 1 — Atomic weight of O = 16
" " C = 12 — " " S = 32
" " N = 14

	Symbol.	Weights.	Atomic Wts.
Atomic weight of methane	H_4C	H= 4, C=12	16
" " ethene	H_4C_2	H= 4, C=24	28
" " carbonic oxide	CO	C=12, O=16	28
" " aqueous vapor	H_2O	H= 2, O=16	18
" " carbonic acid	CO_2	C=12, O=32	44
" " sulphurous oxide	SO_2	S=32, O=32	64

The specific heats, heat units, specific gravities and the weights in the tables, are taken from or deduced from those given in several chemical books which agree. The authorities vary some, but the difference will practically be of little consequence. Substitutions can be made, keeping the relative proportions in mind.

A fifth table comprises the products of combustion multiplied by their specific heats, and the quantity of nitrogen used with the air required for the exact combustion of the gases, multiplied by its specific heat, and also with one and a half, two and three times the air required. These figures give the pounds of water heated 1°, and are useful in ascertaining the temperatures of the gases.

TABLE 5.

Hydrogen Products.		*Carbon Products.*	
H_2O	4.3245	CO_2	.7953
Nitrogen in air for exact combustion	6.5296	Nitrogen in air for exact combustion	2.1771
	10.8541		2.9724
1½ times the air required	4.1336	1½ times the air required	1.3787
	14.9877		4.3511
Twice the air	4.1336	Twice the air	1.3786
	19.1213		5.7297
3 times the air	8.2672	3 times the air	2.7573
	27.3885		8.4870

TABLE 5—*Continued.*

Carbon Oxide Products.

CO_2	.3408
Nitrogen in air for exact combustion	.4664
	.8072
1½ times the air required	.2953
	1.1025
Twice the air	.2952
	1.3977
3 times the air	.5905
	1.9882

Light Carbureted Hydrogen.

H_2O	1.0811
CO_2	.5965
	1.6776
Nitrogen in air for exact combustion	3.2648
	4.9424
1½ times the air required	2.0670
	7.0094
Carried forward	7.0094
Twice the air	2.0669
	9.6763
3 times the air	4.1339
	13.2102

Heavy Carbureted Hydrogen.

H_2O	.6178
CO_2	.6817
	1.2995
Nitrogen in air for exact combustion	2.7984
	4.0979
1½ times the air required	1.7717
	5.8696
Twice the air	1.7716
	7.6412
3 times the air	3.5433
	11.1845

These data illustrate the well known principle that no more air should be used than circumstances require.

We are now prepared to make practical use of the tables. Having obtained an analysis of the gas to be used by any of the methods employed for that purpose, convert the cubic feet of the proximate elements into pounds by Table 3. Multiply these weights by their respective heat units and add. The sum will give the number of heat units of 1,000 cubic feet of the gas. Add together the weights of the component parts; this will give the weight of the 1,000 cubic feet.

The total heat units divided by the weight of the 1,000 cubic feet will give the heat units per pound, and these can then be compared with those of any other combustible, solid, liquid or gaseous. For instance, take the London common gas from Newcastle coal as given in the manuals:

Components.	Cubic Feet.	Pounds.	Heat Units.	Total Heat Units.
H	460	2.573	53,330	137,218
H_4C	395	17.675	22,065	389,999
H_4C_2	38	2.976	20,940	62,317
CO	75	5.873	4,400	25.841
CO_2	7	.861	0	00
H_2O	20	1.006	0	00
N	5	.392	0	00
	1,000	31.356		615,375 per 1,000 cu. ft.

$$\frac{615.375}{31.356} = 19{,}625 \text{ heat units per pound.}$$

Since 1,000 cubic feet of air weigh 80.5 pounds, $\frac{31.356}{80.5} = .389$, specific gravity of the gas.

Ultimate Elements, Products of Combustion and Temperature.

Symbol.	Pounds.	H, Pounds.	C, Pounds.	O, Pounds.
H	2.573	2.573		
H_4C	18.675	4.419	13.256	
H_4C_2	2.976	.425	2.551	
CO	5.873		2.517	3.356 = to 11.235 lbs. N not in the air
	29.097	7.417	18.324	Totals of N.
Requiring oxygen =		59.336	48.864	
to make		H_2O 66.753	CO_2 67,188	198.613 163.587
and N in the air		198.613	163.587	362.200 11.235
		H_2O	CO_2	
In the gas		66.753 1.006	67.188 .861	350.965 .392
		67.759	68.049	351.357

The quantities of the oxygen above are the products of the H × 8 and the C × 2⅔.

$$\frac{615{,}375}{67.759 \text{ lbs. } H_2O \times .4805 + 68.049 \text{ lbs. } CO_2 \times .2169 + 351.357 \text{ lbs. } N \times .2438}$$

$$= \frac{615{,}375}{132.979} = 4{,}627° \text{ temperature.}$$

The following are the sums of the products:

$H_2O = 32.558$
$CO_2 = 14.760$
$N = 85.661$
132.979

It will be perceived that there has been added to the carbon in the carbonic oxide, two parts of oxygen to make the carbonic acid, which is correct; but as only one part of oxygen was supplied from the air for this purpose, there has been deducted from the nitrogen, answering to the oxygen employed in the calculation, the nitrogen, viz., 11.235 pounds, corresponding to the 3.356 pounds oxygen in the carbonic oxide, in order to have the correct quantity of nitrogen used. This is a fixed rule in all similar calculations.

Take a second example, that of cannel gas:

Components	Cubic Feet.	Pounds.	Heat Units.	Total Heat Units.
H	277	1.549	53,330	82,608
H_4C	500	22.373	22,065	493,660
H_4C_2	130	10.180	20,940	213,169
CO	68	5.325	4,400	23,430
CO_2	1	.123	0	00
H_2O	20	1.006	0	00
N	4	.313	0	00
	1,000	40.869		812.867 per 1,000 cu. ft.

$$\frac{812.867}{40.869} = 19{,}890 \text{ heat units per pound.}$$

$$\frac{40.869}{80.5} = .508 \text{ specific gravity.}$$

Ultimate Elements, Products of Combustion and Temperature.

Symbol.	Pounds.	H, Pounds.	C, Pounds.	O, Pounds.
H	1.549	1.549		
H_4C	22.373	5.593	16.780	
H_4C_2	10.180	1.454	8.726	
CO	5.325		2.282	3.043 = to 10.187 lbs. N not in the air
	39.427	8.596	27.788	Totals of N.
Requiring oxygen =		68.768	74.101	
to make		H_2O 77.364	CO_2 101.889	230.223 248.077
and N in the air		230.223	248 077	478.300 10.187
		H_2O	CO_2	
In the gas		77.364 1.006	101.889 .123	468.113 .313
		78.370	102.012	468 426

The quantities of the oxygen above are the products of the H × 8 and of the C × 2⅔.

$$\frac{812{,}867}{78.370 \text{ lbs. } H_2O \times .4805 + 102.012 \text{ lbs. } CO_2 \times .2169 + 468.426 \text{ lbs. } N \times .2438}$$

$$= \frac{812.867}{173.985} = 4{,}672° \text{ temperature.}$$

The following are the sums of the products:

$H_2O = 37.657$
$CO_2 = 22.126$
$N = 114.202$
173.985

As a third example, take another analysis of cannel gas:

Components.	Cubic Feet.	Pounds.	Heat Units.	Total Heat Units.
H	456	2.551	53,330	136,045
H_4C	349	15.617	22,065	344,589
H_4C_2	41	3.211	20,940	67,238
H_8C_4	24	3.759	20,940	78,713
CO	66	5.168	4,400	22,739
H_2S	3	.285	7,545	2,150
CO_2	36	4.430	0	00
N	25	1.958	0	00
	1 000	36.979		651,474 per 1,000 cu. ft.

$$\frac{651.474}{36.979} = 17{,}617 \text{ heat units per pound.}$$

$$\frac{36\ 979}{80.5} = .459 \text{ specific gravity.}$$

Ultimate Elements, Products of Combustion and Temperature.

Symbol.	Pounds.	H, Pounds.	C, Pounds.	S, Pounds.	O, Pounds.
H.	2.551	2.551			
H_4C	15 617	3.904	11.713		
H_4C_2	3.211	.459	2,752		
H_8C_4	3.759	.537	3,222		
CO	5.168		2,215		2.953 = to 9.886 lbs. N not in the air
H_2S	.285	.017		.268	
	30.591	7.468	19,902	.268	Totals of N. 225.014
Requiring oxygen =		59.744	53,072	.268	244.304
to make		H_2O 67.212	CO_2 72,974	SO_2 .536	1.794
and N in the air		225 014	244.304	1.794	471.112 9.886
In the gas		H_2O 67,212	CO_2 72,974	SO_2 .536	461.226
			4,430		1.958
		67.212	77,404	.536	463.184

$$\frac{651,474}{67.212 \times .4805 + 77.404 \times .2169 + 463.184 \times .2438 + .536 \times .1540} = \frac{351,474}{162.091} = 4{,}019° \text{ temperature.}$$

The following are the sums of the products:

$H_2O = 32.295$
$CO_2 = 16.789$
$N = 112.924$
$SO_2 = .083$
162.091

Let pure water gas, made by passing steam through incandescent car bon, and having the composition H + CO, be a last example:

Components.	Cubic Feet.	Pounds.	Heat Units.	Total Heat Units.
H	500	2.797	53,330	149,164
CO	500	39.153	4,400	172,273
	1,000	41.950		321,437 per 1,000 cu. ft.

$$\frac{321,437}{41.950} = 7{,}663 \text{ heat units per pound.}$$

$$\frac{41.950}{80.5} = .521 \text{ specific gravity.}$$

Ultimate Elements, Products of Combustion and Temperature.

Symbol.	Pounds.	H, Pounds.	C, Pounds.	O, Pounds.
H	2.797	2.797	16.780	
CO	39.153			22.373 = to 74.901 lbs. N not in the air
	41.950	2.797	16.780	Totals of N. 74.911
Requiring oxygen =		22.376	44.747	149.805
to make		H_2O 25.173	CO_2 61.527	224.716 74.901
and N in the air		74.911	149.805	149.815

$$\frac{321,437}{25.173 \text{ lbs. } H_2O \times .4805 + 61.527 \text{ lbs. } CO_2 \times .2169 + 149.815 \text{ lbs. } N \times .2438} = \frac{321,437}{61.966} = 5{,}187° \text{ temperature.}$$

Sums of the products:

$H_2O = 12.096$
$CO_2 = 13.345$
$N = 36.525$
61.966

Additional examples might be given, but the foregoing are probably sufficient to illustrate the principle and its application, and the result.

The writer of this communication has thought this subject worthy of study, for the reason he is convinced that the use of gas for fuel ought to be and will be largely in excess of that used for light. The increase and the consequent reduced cost of manufacture will not only add to the business and profits of the companies in general, but by favoring a reduction in the selling price will also increase the quantity of gas sold for lighting, and insure its use for that purpose. In elucidation of this statement it is only necessary to mention the following: Siemen's gas, having a composition of about 200 cubic feet of carbonic oxide and 800 cubic feet of nitrogen in 1,000 cubic feet, and having a heating capacity of about 900 units, is known to be more economical than the direct use in metallurgy of solid coal having 13,000 heat units. The heating capacity of the London common gas, as shown in a previous table, is 19,625 units, which is 20 times greater than that of the Siemen's gas.

It is stated in the books of reference that 13 feet of common coal gas has a heating value, in the boiling of water, equal to 1 pound of coal. Gas of specific gravity .420 weighs 33.9 pounds per 1,000 cubic feet; 13 feet weighs .4407 pounds, and $\frac{13,000}{.4407} = 29{,}498$ heat units, which is 2¼ times the theoretical heat units of coal.

The manuals also give as the heating value of common coal gas 21,100 heat units. In an example given previously, the calorific value of common coal gas was found, by calculation, to be 19,625 heat units, which it will be noticed is not in excess.

It may also be desirable to bring to mind the fact that when two elementary gases chemically combine, the heat units of the combined gas are less than the average, per pound, of those of the combining gases. When, however, there is only a mechanical mixture of the component gases, as in coal gas, the heat units do not undergo the like contraction in the mixed gas. The diminished heat units, 19,625, of the coal gas referred to, are not owing to chemical combination and condensation, but to the non-heating components, carbonic acid, aqueous vapor and nitrogen.

A New Sulphide of Carbon.

By Mr. A. E. Tutton.

A new liquid sulphide of carbon of the composition C_3S_2 has been isolated in a somewhat remarkable manner in the chemical laboratory of the university of Buda Pesth, by Professor von Lengyel, who contributes an account of it to the current "Berichte." In addition to the well known disulphide of carbon, several other substances supposed to be compounds of carbon and sulphur have from time to time been described; but as they appear to have been amorphous insoluble solids very difficult to purify, there is very little evidence of their being definite compounds. The substance now described, however, appears to be a very well characterized liquid compound of unmistakable odor and corrosive action upon the skin, and capable of being distilled under diminished pressure.

The method of preparing it was accidentally discovered during the elaboration of a number of lecture experiments illustrating the synthesis and decomposition of carbon disulphide. It was long ago pointed out by Berthelot that this familiar substance decomposes at a temperature but slightly higher than that at which its formation from its constituents occurs. Buff and von Hofmann subsequently showed that the temperature of a glowing platinum wire was ample to bring about slow dissociation of the vapor, and that the disruption of the compound occurred very rapidly indeed at the temperature of red hot iron wire. An experiment was therefore arranged to ascertain whether rapid removal of the vapor of the synthesized compound from the heated sphere of action would largely prevent the loss by dissociation, and in order that the test should be a severe one, the rapidly moving vapor was subjected in its passage to the high temperature of the electric arc. It was during this experiment that the new sulphide of carbon was unexpectedly produced.

A little more than a hundred cubic centimeters of carbon disulphide were placed in a flask arranged over a water bath. A large globe had been previously sealed on to the neck of the flask, through tubuli, in which the carbon electrodes were inserted. To a third tubulus of the globe an upward condenser was fitted, the interior tube of which was finally bent downwards to serve as a gas delivery tube. The water bath was then heated, and the carbon disulphide maintained in rapid ebullition; the electrodes were approached until the powerful current from accumulators was transmitted, and then withdrawn so as to generate the arc. The electric arc in carbon disulphide vapor under these conditions is a remarkable phenomenon; it is seamed with a dark band passing along its center from pole to pole, and the brightest spots of the incandescent terminals are just where the band appears to touch them. The

carbon disulphide was kept boiling and the arc passing for a couple of hours, during which the globe was filled with the vapor, which condensed in the condenser, and fell back into the flask. The interior of the apparatus soon commenced to blacken with liberated carbon, which collected upon the surface of the liquid, and an extraordinarily strong tear-exciting odor soon made itself evident in the neighborhood of the apparatus. At the conclusion of the experiment the residual liquid was cherry-red in color, and was transferred to a closed vessel containing copper turnings in order to remove the free sulphur present. After being thus left for a week it was filtered, and the carbon disulphide evaporated at a low temperature in a current of dried air, in order, if possible, to isolate the substance endowed with the powerful odor. Eventually a few cubic centimeters of a deep red liquid, the new sulphide of carbon, were left, which possesses the odor in greater intensity, a trace of the vapor producing a copious flow of tears, accompanied by violent and persistent catarrh of the eyes and mucous membrane. A drop of the liquid, moreover, at once blackened the skin.

The specific gravity of this liquid is 1.2739, so that it sinks under water, with which it does not mix. When heated, it polymerizes into a hard, black substance. If the rise of temperature is gradual the change occurs quietly, but when rapidly heated to 100–120° the polymerization takes place with explosive force, the interior of the vessel being covered with projected deposits of the black substance. Analysis, both of the liquid and of the black solid, indicates the same empirical formula, C_3S_2, and molecular weight determinations of the liquid, dissolved in benzine, by Raoult's method, agree closely with the molecular weight corresponding to that formula. The liquid can be partially distilled at 60° *in vacuo*, a small portion, however, always polymerizing. The liquid, moreover, spontaneously changes in a few weeks into the more stable black solid modification. The solutions of the liquid in organic solvents likewise slowly deposit the black form.

The liquid readily ignites, burning with a luminous flame and forming dioxides of carbon and sulphur. Caustic alkalies dissolve it, forming dark colored solutions, from which dilute acids precipitate the polymerized black compound. With alcoholic potash the action is very violent. A drop of concentrated sulphuric acid causes instant passage to the black form, accompanied by a hissing noise. Nitric acid provokes an explosion and ignition, but 70 per cent. acid dissolves it completely and quietly.

The black polymeric modification is readily soluble in caustic alkalies, but acids reprecipitate it unchanged. When heated it undergoes a remarkable change, sulphur subliming, and a gas, inflammable and containing sulphur, but not carbon disulphide, is liberated, the nature of which is reserved for a further communication.

The liquid sulphide combines readily with six atoms of bromine, with evolution of heat. The substance is readily isolated when bromine is dropped into a solution of C_3S_2 in chloroform, and it is insoluble in that solvent. Strangely enough, this compound, $C_3S_2Br_6$, is endowed with a pleasant aromatic odor, two substances of frightful odors thus uniting to form an agreeably odoriferous compound, a striking example of the effect of chemical combination.

Colorado's Oil Production.

The producing petroleum district af the Rocky Mountain region is at present included in the district known as the Florence oil fields in the valley of the Arkansas river west of Pueblo. These oil deposits, while they have been producing for many years, are said by experts to be very different in their character from those of Pennsylvania and Ohio, for while petroleum in these States is invariably in large quantities in a stratum of sand below the shale, in Florence the oil is found in the shale strata itself, hence doubts are expressed by experienced oil experts as to the permanency of the supply. They do not hesitate, however, to assert that the oil exists in inexhaustible supply all through the Rocky Mountain sections of Colorado and Wyoming. The oil belt is known to extend from Central Wyoming south beneath the western portion of Colorado as far as the Grand Valley near Grand Junction. Even in the immediate vicinity of Denver—where experimental wells have been sunk to a depth of 2,800 feet, both oil and gas have been found and those interested in these explorations express confidence in their ability to develop both oil and gas supplies within 10 miles of Denver. Their operations are confined to land located about 9 miles north of Denver. So, while the present productive oil field is limited to Florence, Colo., and Casper, Wyo., the area of petroleum deposits is immense in its extent.

The output of the petroleum wells at Florence is about 2,000 barrels of crude oil daily, which produces from 36 to 40 per cent. of refined oil. The oil is pumped from depths varying from 1,400 to 2,100 feet and finds its way into storage tanks which have a combined capacity of 300,000 barrels. These wells have been pumping more or less daily for about eight years and show no diminution in the force of the flow or change in the character of the oil. The Florence petroleum lands are owned by four large companies, as follows: The United Oil Company, capital $2,000,000; the Rocky Mountain Oil Company, capital $1,000,000; the Florence Oil Company, capital in excess of $500,000; and the Triumph, which is heavily capitalized. A total of about $4,000,000 for the Florence Oil Companies.

Fifty wells are now producing oil, and their combined product is estimated from 2,000 to 2,500 barrels daily. While only 50 wells are producing oil at this time, about 140 shafts have been sunk to the oil deposits, as follows: United, 73; Rocky Mountain, 35; Florence, 26; Triumph, 6.

Crude oil is refined in several large refineries, located at Florence and Overton, a village not far distant from the wells. The Overton refinery belongs to the Rocky Mountain Oil Company and pipes its crude oil through a 4-inch pipe from Florence and has a capacity of 5,000 barrels a day. During the year 1893 the Florence Oil Company completed its second refinery at a cost of $75,000, with a capacity of 1,000 barrels a day. It will soon be in operation. The United Oil Company has made some costly additions to its refining machinery for the manufacture of fireproof oils for use in railroad cars, steamboats, etc. While no very extensive developments have been made in the way of output and increased number of wells during 1893, the improvements made in the way of new refineries and improved machinery have been both costly and substantial, the United Oil Company making an investment during the year in one instance amounting to $100,000.

Colorado's annual oil contribution to the wealth of the West amounts to at least $1,000,000 cash derived from the sale of illuminating oil, machinery lubricants, tar for fuel, candles, axle grease and coke. About 300 men are furnished steady employment in the various departments connected with the oil industry, and the monthly pay roll is not less than $15,000. It is estimated that the outlay for labor for the year will not fall short of $180,000.

Separated from generalization and condensed into facts and figures, the progress of petroleum and gas development in Colorado and Wyoming during the past year may be summarized as follows: New oil wells, 12; new refineries, 2; increased output, daily, 500 barrels; number of men employed, 300; men employed in Wyoming, 50; monthly payroll (Colorado) $15,000; annual output of oil in cash, $1,000,000; present daily output of oil, 2,000 barrels; natural gas discovered at Grand Junction, Col.

Small Electric Light Stations.

[By Mr. J. E. Talbot, in *Engineering Magazine*.]

The business of electric lighting, in its commercial aspect and from the point of view of the central station manager or owner, has been hitherto for the most part involved in mystery. Those who have made and who continue to make money, desire, evidently, to confine their painfully acquired knowledge to the esoteric few, while, on the other hand, those whose experience has been of a different character prefer to maintain a modest and discreet reticence on the subject. Thus, it has been difficult in the past for intending investors in this class of work to obtain unbiased and trustworthy information.

Generally it has been impossible for two or three persons to discuss together the practicability of establishing an electric light installation of moderate size without having let loose upon them a small army of the interesting and active promoter known as the "electric light man." These salesmen, almost invariably of a genial and hospitable turn of mind, usually make things "hum" locally, for a time, and when (if indeed the proposed investors have strength of mind left to postpone any definite action) their missionary efforts are ended, the promoters of the contemplated enterprise discover that they have added to their list of pleasant acquaintances and to their stock of good stories, but that their knowledge of electric lighting matters, instead of being a simple *zero*, has now become a *minus* quantity.

Now, it is a curious condition that each of these representatives of competing, or ostensibly competing companies, really does believe the system he represents to be the best in the world, and he acts according to his faith, if not beyond it, and here arises one of the difficulties that intending purchasers have to meet. This trouble is the tendency of every selling agent to "go" the other fellow "one better." If A says that his machine will operate 500 lights, B says his apparatus, although designed for 550, will be perfectly good for 600, and so on, and it will be

strange indeed if A, being thus challenged, does not rise to the occasion. Then the boiler men and engine men will have their innings, and, under competition, will cut their prices also (and quality at the same time), until, as the total result, the purchasers eventually start with a crippled plant—dynamos too small, engine and boiler capacity too small, and the quality of neither what it ought to be. By this time, moreover, the purchasers probably will have discovered that their plant is in a fair way to cost more than the amount originally believed to be sufficient. This means reduction in construction expenses, poor poles, low priced wire and poor work—all in the end expensive.

The results of this method of procedure are before long apparent in engine troubles, burnt out armatures, hot boxes, grounded circuits, interruption of service, customers' complaints, and consequent loss of revenue. This condition of affairs rapidly produces a general distrust of the whole field of electric work—a condition to be deplored, not only from the point of view of the manufacturer or exploiter of electrical apparatus, but also from that of the purchaser, who thus becomes unnecessarily deprived of and disgusted with an agency capable of providing him with light, heat and power in various convenient forms and methods of application not otherwise available to him.

It would be easy to dilate on the various annoyances and troubles arising from the causes adverted to, but they are so familiar to all who have any experience in this field that it seems unnecessary to do so here. A more important matter would seem to be the pointing out of a remedy for, or rather some preventive measure against the occurrence of such conditions.

When an electric installation is proposed, it is well, if possible, to obtain the services of some one not suspected of having an alliance with any particular manufacturing company, and one who has had practical experience in the direction of the work required—not selecting a telephone man, for example, to advise on a question of power transmission. In past years it has been difficult to obtain competent expert advice outside the staffs of the large manufacturing companies. This is not now the case, however, for some of the best men in the profession are now acting independently of any such connection. But however desirable it may be to procure the best of advice, there are certain points on which some general suggestions may be of value, independently of specific advice relating to particular cases.

It is somewhat difficult to formulate any definite set of questions or points which should be absolutely decided before engaging in an investment of this nature—an investment which in the end may be not only fairly remunerative, but extremely so. There are, at the same time, as already intimated, certain essential and primary matters needing careful attention before such a desirable result can be anticipated. These are:

1. Cost of real estate.
2. Cost of building.
3. Cost of power (water or steam) plant.
4. Cost of electrical apparatus.
5. Cost of outside construction, to include pole line and labor on same, wire and stringing same, hanging arc lamps, and setting converters, if used.
6. Cost of inside wiring.

The first two items depend so largely upon local conditions of price of real estate and building materials that it is scarcely possible to make any intelligible statement in regard to them; they are further dependent as to their amount on items 3 and 4. These must, therefore, be left in abeyance. Item 3 is also dependent on item 4, which, indeed, must always be the final criterion for the whole plant. It will be necessary to a proper decision of this portion of the subject, therefore, to assume some specific capacity of plant.

Suppose that a certain town should require 50 to 60 arc lights for public uses, and about 1,200 incandescent lights for commercial purposes, such as the lighting of stores, hotels and residences. The cost of the electrical apparatus for such a station, installed complete, including the arc lamps, should amount to about $4,500 for the arc lighting, and to about $2,500 for the incandescent, for high-class apparatus. The steam plant, not allowing for any considerable increase, but based on the full electrical load—say 150 horse power—would closely approach the sum of $5,000.

The sum allowed for the construction of the outside lines, such as setting poles, stringing wire, hanging the arc lamps, and placing converters, would vary considerably in different places and under different local conditions. Some general suggestions may be offered, however: For arc circuits about $140 per mile of running wire and running same—using No. 6 B. & S. good weatherproof wire—may be allowed, and for the construction of the pole line, hauling and setting and gaining poles, placing cross arms, pins and insulators, under ordinary conditions, about $160 to $175 per mile is a fair estimate. The primary circuits for an alternating system are dependent on matters other than the mere length of wire used, and in large cities must be calculated carefully and definitely. But in a town of the size under consideration, for the wire and stringing, and the necessary additional cross arms, pins, etc., assuming that the same poles can be used as for the arc circuits, $1,000 should be sufficient. The inside wiring—that extending from the converters to the lamps—ought not to exceed, including the lamp and socket, $2.50 per light of 16 candle power, for plain work. For concealed or special work a larger amount probably would have to be allowed. The cost of converters would be from $1 to $1.50 per 16-candle power lamp capacity.

It will thus be found that for a plant of the size suggested, which would not be unsuitable for a town of 5,000 to 10,000 inhabitants, the promoters would have to reckon on an expenditure of capital, practically in the form of cash payments, amounting to some $17,000, as follows:

Steam plant of 150 horse power, including foundations, stack, piping, belting, etc	$5,000
Electrical apparatus in station, including arc lamps, instruments, switchboards, etc	7,000
Arc circuit, complete, to include poles, wire, hanging of lamps, etc., on the basis of, say, 8 miles of wire and 5 miles of pole line	2,000
Incandescent circuit, primary, utilizing arc light poles	1,000
Converters for 500 light capacity, leaving balance to be purchased as needed	625
Wiring up, with plain wiring—500 lights—to include lamps and sockets	1,250
Total, excluding real estate and buildings	$16,875

It will be seen that no consideration is here had of the direct current system for the incandescent lighting. In a town of the character considered, with the direct current or low tension system either an impracticably large amount of money for the necessary conductors would have to be expended, or parts of the town area would have to remain without service. The business in such a place is necessarily of a scattered nature, while the low tension direct system is more especially adapted to localities in which a large and remunerative amount of work can be obtained within a comparatively short distance from the station. This class of work would more properly be considered with reference to the conditions obtaining in a large city.

There are many other conditions in regard to which the central station manager of a large plant must give careful and anxious thought, such as the kind and quality of fuel, the comparative merits of large and small units of power, the desirability (or the opposite) of direct coupled dynamos; these, however, do not properly come within the scope of a few general hints on small stations. The question of the utilization of the plant during daylight by means of a power service is also one which usually does not arise in connection with these small plants.

It may be thought that the writer is a special advocate of these small electric lighting stations, but this is not the case; unless they are designed and laid out with a view to, and capacity for, rapid and easy extension to meet the demands of the future it is the exception to find them remunerative to a high degree. In many cases, however, they serve to obtain possession of a field for business which in growing towns may rapidly become valuable. But too frequently the projectors disregard these considerations, and the above figures indicate rather the amount of money that such stations *do* cost than the amount that a station laid out on proper lines *ought* to cost. At any rate it is hoped that the figures may prove to be of some value—if not as a guide, then as a warning.

Having estimated the expenditure of capital necessary in the first installation of the plant, the most pertinent matter of inquiry is with regard to the *cost of operation*, as compared with the *total earnings*. It is to be regretted that data of this nature are somewhat reluctantly furnished, but the reason is not hard to understand. Those companies which have been fortunate enough to secure what is colloquially known as a "soft snap" keep their information to themselves to avoid any reduction of the rates that the traffic will bear, while those who have lost money by such an investment do not care to expose what might be considered a want of business acumen.

It is believed that the following figures may be taken as approximately correct, with certain reservations to be adverted to hereafter. Estimates based on general assumptions which are believed to be fair and not unusual will first be given, and certain modifications and corrections to be considered will be dealt with subsequently by way of explanation. The question of revenue is at any rate the more interesting of the two and

will be considered first, although it might be thought by some more proper to consider first the cost of operation.

It should be understood that the figure of $85 per annum for arc lights of nominal 2,000 candle power, burning from dark to midnight, is not entirely arbitrary. It is estimated as an average figure under conditions such as those here assumed. Actual prices range all the way from $60 to $200, under varying circumstances:

Revenue.

Revenue from 50 arc lamps, lighted each night from dark until midnight, under contract with city at $85 per lamp per year.	$4,250
Revenue from incandescent lighting, say *average* load of 500 lamps of 16 c. p. each, for *average* time of 4 hours per night, taken throughout the year = 2,000 lamp hours per night × 365 = 730,000 lamp hours per annum, at 1 cent per lamp hour.....	7,300
Total.....	$11,550

Operating Expenses.

Labor—First engineer.....	$960	
Second engineer or fireman.....	600	
Lamp trimmer and general man.....	600	$2,160
Fuel (estimated at 750 tons of coal af $2.75).....		2,062
Carbons for arc lamps.....		500
Incandescent lamp renewals.....		600
Taxes and insurance.....		600
Collections, bookkeeping, stationery, etc.....		500
Oil and waste		260
Repairs, ordinary.....		200
Allowance for depreciation (say 7½ per cent. on $12,000).....		900
Contingencies and sundries.....		100
Total.....		$7,882

Deducting from $11,550 the sum of $7,882, we have an apparent profit of $3,668, which, as times go, is a very good percentage (about 14½ per cent.) on $25,000, assuming that the total cost of the plant approximates that figure. Now, what are the contingencies which may, and too frequently do, reduce this apparent profit? It will be obvious that these may take the form either of excessive expenditure or of deficient returns.

Excessive expenditure may arise from an excessive consumption of fuel, due to poor quality, careless firing, improper condition of the furnaces or boilers or engines, or of the dynamos or circuits, it being taken for granted that the apparatus was in good condition to start with. A good fireman ought to know how to fire, and if he does not the engineer should show him. Boilers should be cleaned regularly, and engine valves and all other apparatus overhauled and examined at suitable intervals. Hot boxes should never be allowed. All parts should be kept scrupulously clean, and the circuits kept free from grounds. On the incandescent circuits as few and as large transformers as possible should be used, and also lamps of as high an efficiency as is consistent with a reasonably long life. The current on the arc circuit should not be allowed to exceed the standard, nor should the pressure on the incandescent circuit exceed that required to operate the lamps at their rated voltage to deliver their proper candle power. Care, or the reverse, in this direction most materially affects the coal pile. The item of oil, with careless men, frequently assumes alarming proportions.

Large and unnecessary repairs may generally be avoided by foresight in the outset. A little false economy in the installation results in continual repairs to all parts of the plant, from the building itself down to the lamps furnishing the light, not only under the head now being considered, but also by reason of reduced revenues by rebates for defective or interrupted service.

If the lights are extinguished at midnight an economy can be effected in the use of the arc carbons, the unconsumed portion of the upper carbon (the longer) being often sufficient for another night's run, if used as a lower carbon. The use of double carbon lamps will also be found desirable in this direction, as one trimming of the lamp often will serve for two nights, especially in the summer, thus either reducing the wages of the trimmer, or enabling him to assist in other work on the lines or around the station.

These considerations should be known to the man in charge of the plant. But too often they are overlooked, and it is poor economy not to have at least one good man in charge, and a matter of $50 or $100 a year in the pay of that man may be lost or saved many times over in the course of 12 months. After all, "the best system is the man who runs it."

Deficient returns are due, as to the city arc lighting, simply to deductions from the bill on account of lamps not burning. A condition of this kind is frequently imposed upon the lighting company, and these deductions not seldom amount to a considerable sum. But if the station apparatus and lines have been installed properly and cared for, there is hardly any excuse for a complete shut down. The trouble is due usually to careless trimming of some of the lamps, for which the trimmer should be called to account.

Another and more serious difficulty, which applies to incandescent lighting is that possibly the rate assumed in our table cannot be obtained at all. This may be due simply to prejudice, or to the competition of artificial or natural gas. Kerosene can hardly be considered as a competitor.

The rate of 1 cent per lamp per hour is the usual standard rate, whether under contract or measured by meter. Sometimes, in making rates, a reduction has to be made for a customer who takes a large number of lights, and in the case of both contract and meter rates a discount is often allowed for prompt payment. Interruptions of service, too, give rise to claims for rebates which cannot always be resisted, though they should invariably be scrutinized with care. The writer remembers a case where a claim was made by a customer that his store was in darkness, and it appeared that he had omitted to turn on his switch controlling the lights!

Claims for new incandescent lamps are often made. In such cases stubs of the old lamps should always be returned to the station before new lamps are issued, (1) because the lamp factories will allow a few cents for each stub, and (2) for the reason that lamps are sometimes stolen and sold, and new lamps claimed to replace them. A customer who *breaks* a lamp should be charged full price, renewals of lamps burnt out being made by the company.

Bad debts are contingencies which must be taken into account in estimating profits. The item of water for the boilers was designedly omitted from the estimate of operating expenses. It should not be a very large one in any event, but, in locating a station, wherever possible advantage will be taken of natural conditions, and it frequently will be practicable to select a situation where water can be obtained for nothing or at a moderate cost by sinking a well, that cost being added to the capital expenditure. If water has to be purchased, the amount must be added to operating expenses.

The cost of coal varies enormously with different localities; the writer is familiar with lighting stations where good steam coal is delivered in the station for 70 cents and 80 cents a ton (practically the cost of hauling), while at others $5 and $6 has to be paid. The estimated figures given above must be modified to correspond with the actual price. The high price of coal is usually to some extent compensated for by the fact that in such localities a better price can be obtained for light—the converse also naturally being true to a degree.

It is possible that some of the figures given might be criticized from the point in view of the best theoretical engineering practice; here, however, is a condition and not a theory that confronts us, and in the stations now under consideration it would not be practicable to obtain such results as may be arrived at in large installations of possibly several thousand horse power, fortified with the best expert design, supervision and attention.

Fires Caused by Accidents to Oil Lamps.

The London *Journal* states that at the meeting of the Manchester Section of the Society of Chemical Industry on the 1st ult., a discussion took place on the flashing point of mineral oils. It was opened by Mr. J. Carter Bell on some notes forwarded to him by Mr. D. R. Steuart. Mr. Bell stated, in the course of his remarks, that he had received some figures with regard to fires in London in the years 1890–92, from which it appeared that, in 1890, out of 2,555 fires, 271 were due to lamp explosions; and of these, 51 were the result of accidents to the lamps. The total number of deaths was 61, of which 15 were due to such accidents. In 1891 there were 290 fires due to lamp explosions, 46 explosions caused by accidents to lamps, and 12 deaths attending these accidents. In 1892 the figures were: 275 fires, 82 from explosions, and 16 deaths. In a communication to *Fire and Water* Mr. Steuart gave a table of the total fires since March, 1892. Of 1,791 English fires, 156, or 8.71 per cent., were caused by lamps; of 1,765 Scotch fires, 35, or 1.98 per cent.; of 261 Dublin fires, 18, or 6.89 per cent. Of 10,840 fires in New York and Chicago, 1,002, or 9.24 per cent., resulted from lamps. The percentage in Toronto was 8.10; in Paris, 23.91, but inclusive of more than lamp accidents. In Berlin, out of 2,574 fires, 650, or 25.25 per cent., were caused by lamps. These are really serious figures. The result of the discussion was the passing of a resolution to the effect that the present legal flashing point of mineral oil ought to be increased to a standard of not less than 100° F.

Inclined Retorts at the Rochdale Corporation Gas Works.*

There is no labor more severe than that of emptying gas retorts when the coal is carbonized. The heat and smoke are almost intolerable, while the physical exertion required is very great. Several plans have been tried to effect this result by mechanical means; hydraulically operated rakes are in use in Manchester; in other places the scoop is used, while recently the inclined system of setting the retorts has come into vogue. While the two former methods of operation show little sign of extending, the latter is being rapidly adopted. Within four years over 35,000 lineal feet of inclined retorts have been erected under the patents of the Automatic Coal Gas Retort Company, Limited, of 86 and 88A, Leadenhall street, London, the value of the work exceeding $900,000. During the four years very great improvements have been effected, until now the system is almost perfect. In order to show the latest arrangements, we illustrate a large plant of this kind recently erected at Rochdale.

Early in 1890 five settings of 21 in. by 15 in., Ω-section retorts, 15 ft. long, were erected at Rochdale, this being the first installation working in the provinces. The result of the three years' working of these retorts is the further erection of this large installation.

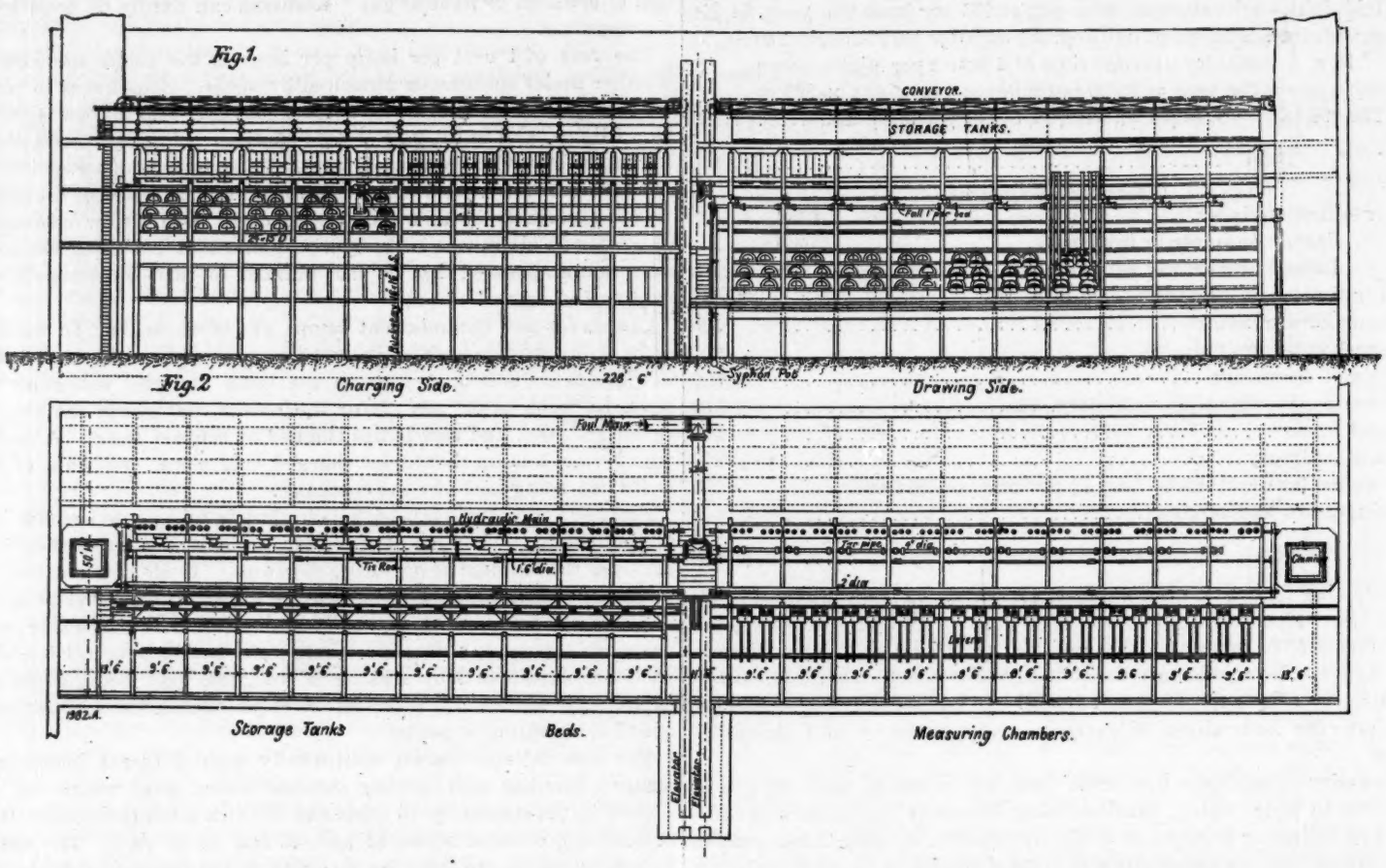
Mr. Ball, who was assisted by Mr. Maurice Graham, A.M.I.C.E., the engineer of the Automatic Coal Gas Retort Company, Limited, the licensees of the patent rights, designed the following scheme.

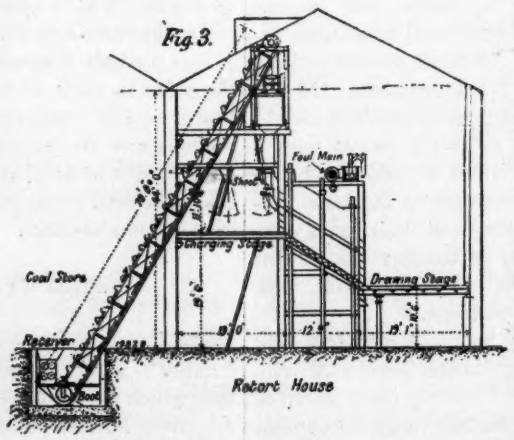
The retort house, which has been specially built to suit the system, is 50 ft. 10 in. wide and 230 ft. long, the height being 44 ft. to the eaves. Adjacent to this house and running parallel are the coal stores. The building, although not shown in detail, is so arranged that, upon any extension of the system, one side wall will be taken down and another similar sized retort house built alongside, the roofs being supported in the center by a series of iron supports and bracing, the whole constituting a retort house 100 ft. wide, and capable of holding twice as many beds as now shown.

The installation is designed to carbonize 168 tons of coal per day, or a make of gas equal to 1,680,000 cubic feet, and is worked out on the basis of what is being done at present.

*From *Engineering*.

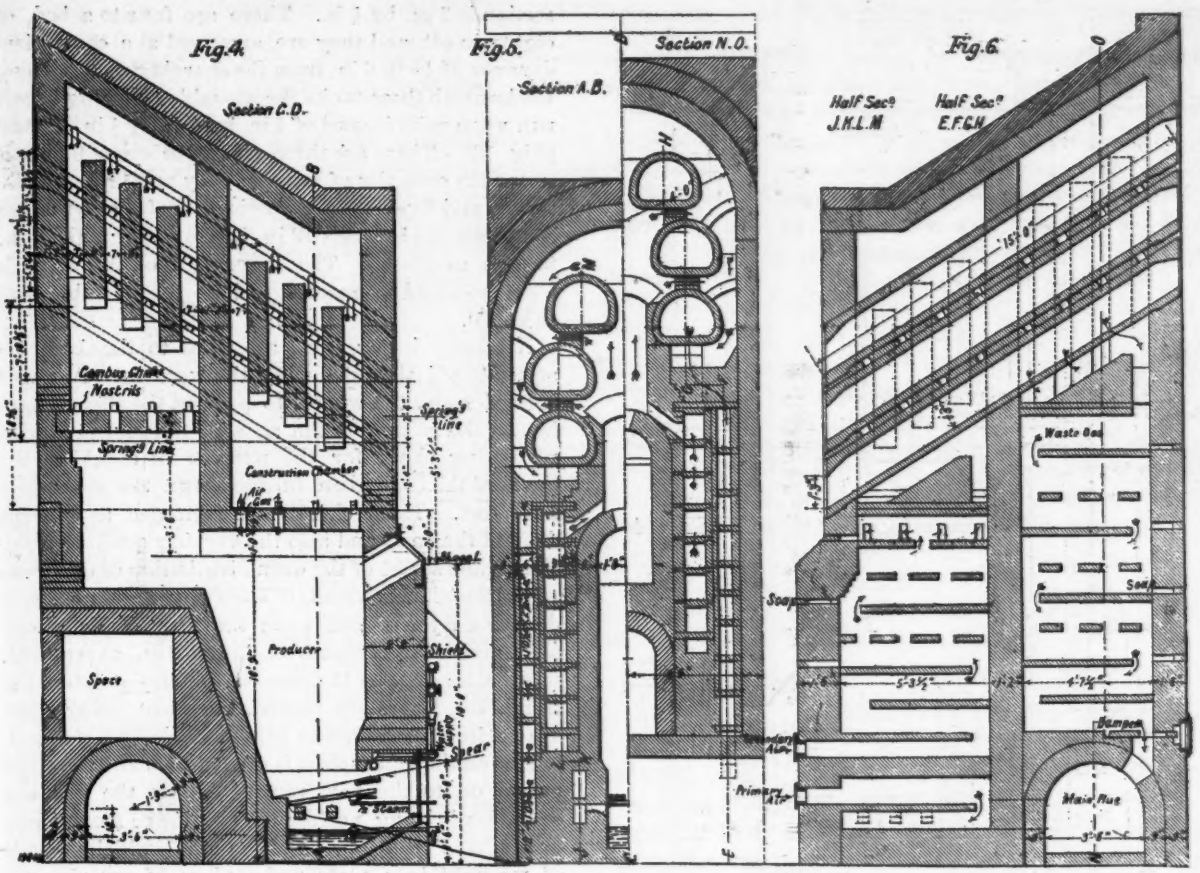
The heating arrangements are upon the gaseous firing system, and have been tested and found efficient upon the five beds now working. The producer is built in two parts, and steps up as shown in Fig. 4; this is to allow a more even distribution of carbonic oxide at the nostril holes. The setting is also divided in halves by the solid wall, so that each portion of it can be more successfully governed by means of the damper, there being one damper to each corner of the bed. The products of combustion circulate through the setting over the top retorts and down the outer sides as shown (Fig. 8), then under the bottom retort and away to the regenerator. The latter is constructed of a series of firebrick chambers running zigzag backwards and forwards, the air passing upwards through one part and the waste gases downwards through the adjacent chamber on their way to the main flue. The bottom of the furnace is provided with the usual fittings applicable to this class of firing.





The retorts are inclined at an angle of 32° from the horizon (Fig. 9), this having been found to be about the angle which suits the charging and drawing of the retorts. The chimneys are arranged one at each end of the bench of settings, and each deals with the waste products of ten beds.

The whole of the brickwork is substantially braced together by a series of buckstays at 9 ft. 6 in. centers made of 12 in. by 6 in. steel, together with transverse ties of 8 in. by 4 in. steel, the longitudinal wrought iron tie rods being 2 in. in diameter, and provided with union joints for tightening up. The buckstays, as will be seen, answer the double purpose of bracing the settings and also supporting the stages, coal tanks and conveying machinery overhead. The mouthpieces (Fig. 8) are fixed to the retorts by bolts and supported by means of four rows of T-iron, running parallel the whole length of the bench. As regards the mouthpieces, these are made of the same section as the retorts, and are provided with self-sealing lids and fasteners. Upon the bottom mouthpiece is fixed the 7-in. diameter ascension pipe (Fig. 8) for taking the gas off from the retort and conducting it to the hydraulic main overhead. This is made of 2½ in. by 2½ in. by ⅝ in. L-iron, and the shell of ¼-in. steel plate, and is of a convenient section, so as to facilitate the easy removal of the tar and liquor within the main. Attached to it is the hydraulic valve for regulating the flow of gas as well as the amount of seal for the dip pipe as shown. The gas from the



hydraulic main is collected by the 18 in. diameter foul main which runs by the side of it. This is made of ¼ in. steel sheet in lengths of about 20 ft. each. Underneath this main a tar pipe is fixed for taking off the tar; this pipe has a fall of 1 in. in every 9 ft. 6 in. Its ends are sealed by means of the syphon pots as shown. From the retorts the gas is thus conducted to the condensers outside the retort house by means of this main pipe.

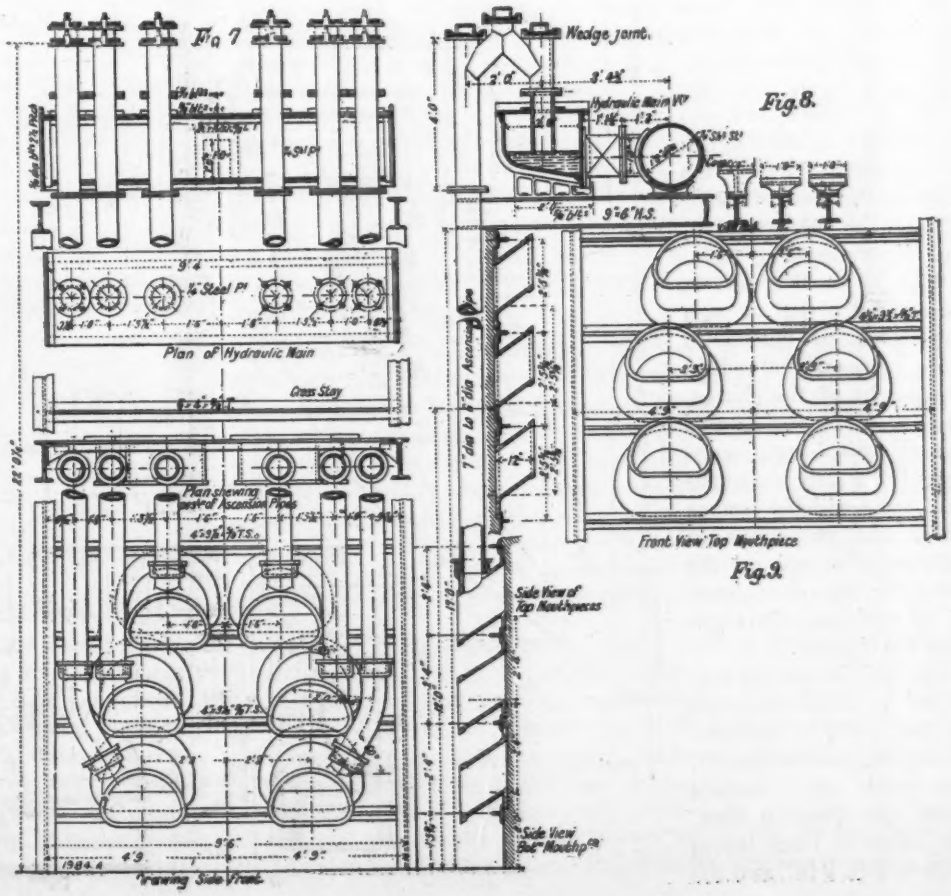
Unfortunately the railway does not run near the gas works, and the whole of the coal has to be carted from the railway siding. The carts, however, enter the coal stores about 32 ft. above the ground line of the retort house, and an arrangement for easy tipping is provided. The coal store (Fig. 3) is 40 ft. wide, so that there is a storage capacity for over 6,000 tons of coal. In the center of the retort house and between the two benches, the coal handling plant is fixed (Figs. 1 to 3). Provision is made for continuous feeding in the coal stores by building two walls and covering them over by a wood frame and a ⅛ in. steel covering for the coal to slide down to the coal breakers.

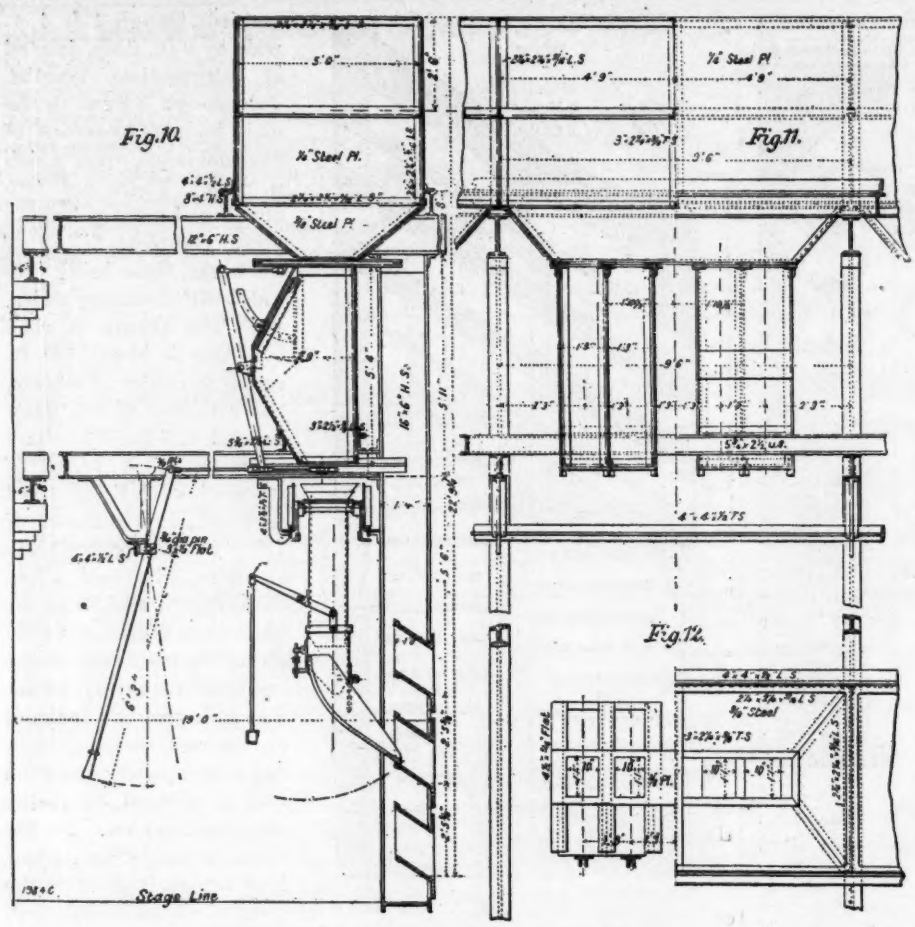
The coal handling plant is divided into two parts, each of which is capable of feeding 10 large coal tanks with a sufficient quantity of coal for the 24 hours' consumption. The elevators are 70 ft. center to center of driver and driven wheels, and are made up of a framework composed of 3 in. by 3 in. by ⅜ in. angle steel, with the necessary ties and struts as shown (Fig. 3). The guides are provided with movable strips fastened on by means of countersunk headed bolts, so that they can be renewed when necessary. Underneath and upon the return guide for the buckets a casing is provided and made of ⅛ in. sheet steel. At the bottom of the elevators the breakers are fitted, and are capable of dealing with any class of coal or cannel, breaking it to a convenient size of 2½ in. cube. The crushing rollers travel at the rate of about 12 revolutions a minute, and act as a feeder to the boot of the elevator. The whole of the coal—large and small—passes through the breaker. The buckets are made of steel, and are seamless, and the chain is also made of steel links, provision being allowed for a bucket about every 1 ft. 6 in. in its entire length.

The conveyers are each formed of a framing composed of 2½ in. by 2½ in. by $\frac{5}{16}$ in. angle steel, with the necessary ties, struts, etc., and fastened on to a cast iron trough 1 ft. 6 in. wide by 6 in. deep, jointed at intermediate lengths. This trough is fixed to the main hoppers by means of channel irons, upon which it rests. There are two openings for every bed, to allow complete filling of the tanks, these being provided with necessary slides, etc. The length of each conveyer is about 100 ft. center to center of wheels, the diameter of the latter being 2 ft. 9 in. The chain is made of a series of stamped steel links, fixed to which, at a distance of 1 ft. 6 in., are the steel plate scrapers. A bar runs across the scrapers, and forms the basis upon which they slide along the top flange of the conveyer trough as shown. The filling of the tanks is continuous, because when one is completely filled the coal is scraped on to the next, and so on. At the end a wrought iron overflow trough leading to the ground is provided, and acts as a tell-tale for the engine man. The drives are so arranged that should it be necessary to stop one engine, breaker or elevator, the other set are large enough to elevate the total quantity of 20 tons per hour, and distribute it to both conveyers. A deposit box is provided at the top of the elevators, and inside it is fixed a movable deflecting plate to change the direction of the coal to either conveyer as desired.

There are two 10 horse power horizontal high pressure non-condensing steam engines fixed underneath the charging stage and near the breaker.

The continuous coal storage tank is composed of a framing of 2½ in. by 2½ in. by $\frac{5}{16}$ in. angle steel plate (Figs. 10 and 11). At the lower part each tank tapers at every 9 ft. 6 in., so as to form a spout for feeding





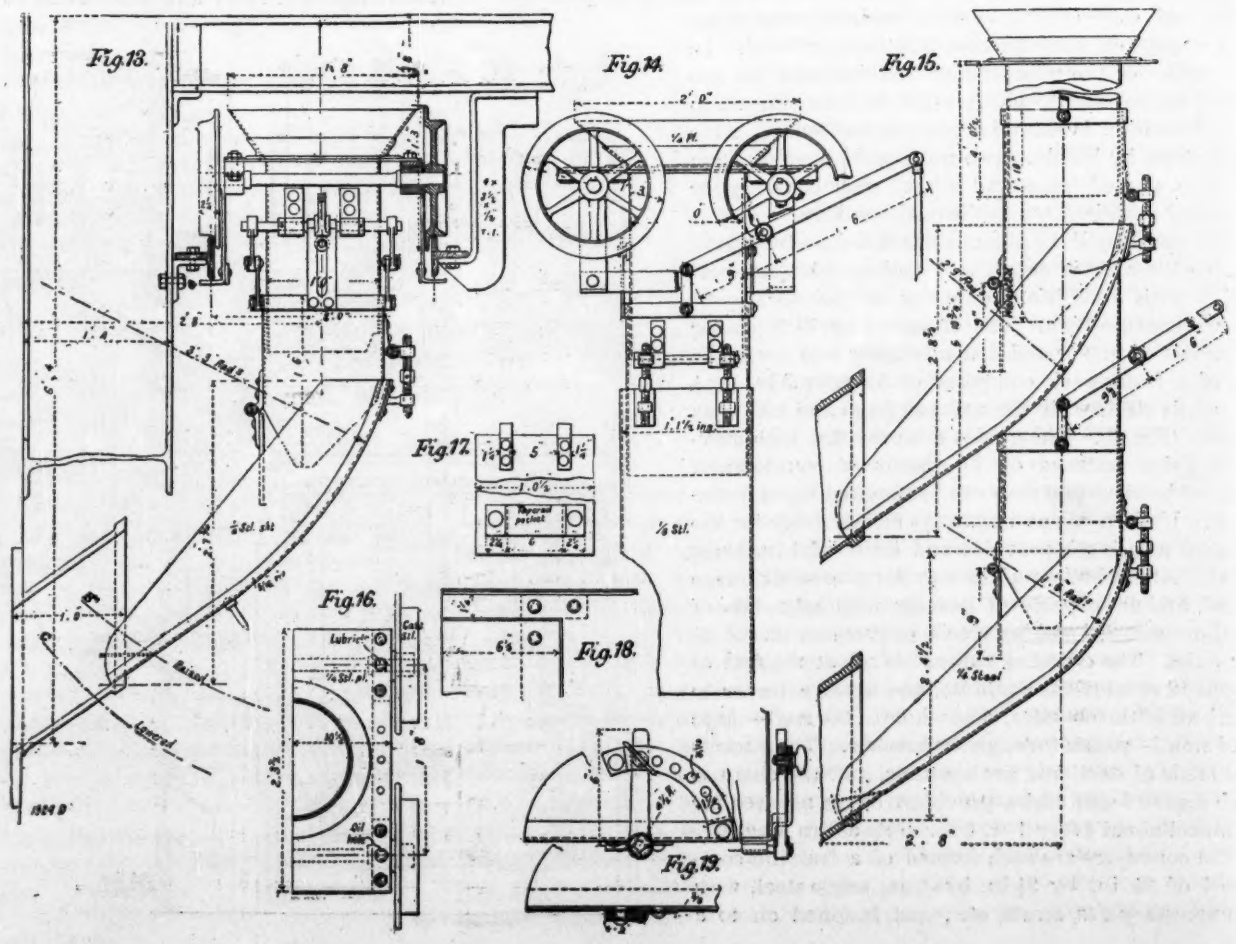
the chambers that are fixed directly underneath. The whole of the work is riveted by ½-in. diameter rivets, 3 in. pitch. The bottom part of the tank is formed of ⅜ in. steel plate, with the four necessary openings as shown. The measuring chambers are bolted thereto by means of ⅝ in. diameter specially shaped bolts. The chambers are supported by the longitudinal channel supports which rest upon the transverse steel girders, 8 in. by 4 in. steel, as shown. The construction may be defined as a framework of 2¼ in. by 2¼ in. by $\frac{5}{16}$ in. angle steel fixed together so that there will be an arrangement of "twin chambers," the shell being made of ¼-in. steel plate.

Two doors are provided, one at the top and one at the bottom, and connected by means of connecting-rods and levers, etc.; the whole working upon a center bearing, as shown, has an action similar to the shot flask, when one door is open the other is shut, and *vice versa* (Fig. 10.)

Each of these chambers holds 7 cwt. of coal, enough for one charge; but should it be necessary to reduce the weight of the charge, this is done by means of a movable diaphragm—connected to which is a quadrant, etc.—with the various holes and reductions in weights tabulated on the same for the convenience of the workman who regulates the charges.

The main levers are connected to these chambers by means of ⅝-in. diameter connecting rods as shown, and work upon centers above the charging floor. The length of these levers is about 6 ft. 3 in., and the section is 3 in. by ⅝ in. There are four to a bed, or eighty in all, and they are arranged at a convenient distance of 10 ft. 6 in. from the charging mouthpieces. Underneath these tanks the movable charging shoots run upon rails formed of 4 in. by 4 in. by ½ in. T-steel (Fig. 13). There are three shoots to every five beds—one for each tier of retorts; they are 12 in. in diameter, and fixed upon a carriage or frame running upon cast steel wheels 12 in. in diameter, with 1½-in. flanges, as shown. The lower part of the shoot is telescopic, and connected to it is the movable shoe (Fig. 15).

Necessary levers, etc., are fixed to the shoot for accurate adjustment during the working. A guard is fixed under the wheels to prevent the shoot jumping off the rails. At the nose of the shoe is fixed a regulating check for the purpose of checking the speed of the coal when falling down the shoot into the retort. These checks are regulated to suit the drop of the coal, and also the varying qualities used. The whole secret of the even distribution of coal rests upon the check, which, if carefully regulated, will deliver a layer of coal upon the floor of the retort, averaging in thickness from 6 in. to 8 in., as required, in the time of 10 to 15 seconds. When the charge has fallen, the levers are moved, the shoot being withdrawn from the retort by this means. The self sealing lid on the mouthpiece is then closed, and the shoot passed on to the next retort. When the drawing operation is being performed, the lower mouthpiece door (Fig. 7) is opened, and the stop—which is made of wrought iron plate and a piece of gas pipe, inserted in the front of the lid to prevent the coal falling upon the latter—is withdrawn, and if the charge is well burnt off the coke slides out, and is directed by means of the fire screens to the cellar underneath, to be quenched and taken away to the yard. The drawing stage is made of 8 in. by 4 in. steel, with intermediates of 4 in. by 3 in. steel, and supported by cast iron columns. The whole is filled up with concrete, upon which is run a layer of Portland cement, and then faced with blue brick laid on edge. Necessary ladders, staircases, etc., are provided for attending to the several working parts, and the whole house is fitted with the very latest improvements applicable to retort houses.



The Treatment of Ammonia Liquor.

Herr Blum says that the preparation of ammonium sulphate in the eastern provinces of Germany is accompanied by many difficulties, and then goes on to say :

On the one hand, the market for the disposal of the salt lies in Central Germany, and, on the other, the sulphuric acid is difficult to obtain, its price being, for example, nearly twice as high as in Oberschlesien. In small works the circumstance must also be remembered that continuous work is impossible, and that therefore the quality of the product produced is not always so high as is the case when the manufacture is carried on regularly. Such works have then to make concessions in price, on account of low percentage of nitrogen or too high amounts of free acid. In addition to this, the manufacture of sulphate of ammonia is being more and more taken up by the coking establishments, which are able, from the enormous amount of ammonia produced and the natural conditions of work, to prepare the sulphate at a lower price.

These works are on such a scale that the acid can be ordered by the truck load, and is then run into closed holders at a low level, from which it is forced by air pressure into high-level holders, whence it passes directly into the saturating vessels. The acid itself, in Oberschleisen for example, can be obtained very cheaply from the neighboring works, and the steam required is obtained without cost by means of the waste gases from the coke ovens. The distribution of the product is effected by connection with the neighboring railroads, wages are low, and, in short, everything is favorable to the manufacturer. Small works can only compete with these large establishments under great disadvantages, and are therefore recommended to either make the finer products, such as ammonia solution, liquid ammonia, etc., in which case, however, the difficulty of transport is not avoided, or to sell the liquor to works which make this class of product. The coking establishments are not fitted, owing to the character of their work, for the manufacture of these secondary products, and the chemical works, which work up the ammonia, must therefore be the centers for the treatment of the liquor. For this purpose, however, the liquor from the smaller works must be supplied in a concentrated form. The ammonia water as produced at the gas works contains usually from 1.2 per cent. of ammonia, and the transport of such material is rendered a serious item by the 98.98 per cent. of water which is also carried. The object to be aimed at then is the concentration of the water on the spot to a strength of about 15 per cent. If this be done, the cost of transport is sufficiently low to allow of a profit, even when the article is sent to very great distances.

The transport can be effected in special wagons sent by the purchasing works if a railway is in the neighborhood, or in separate iron vessels. I have commissioned the firm of Messrs. Kunheim & Co., Berlin, Niederschonweide, to place such tanks for transport at the disposal of the gas works in the district, as has long been done by the Mannheim chemical works.

This works (in Berlin) is, moreover, ready to enter upon long term contracts with the single gas works for the purchase of concentrated liquors. The contracts would be drawn up in such a way that the purchasing works would supply the transport tanks carriage free, and pay for the ammonia in the concentrated liquor a price corresponding to the state of the market, and fixed beforehand.

By means of an arrangement of this kind, the gas works, however small, insure a regular sale of their ammonia water, and, as has been proved by experience, a reasonable profit. In works that produce 400,000 cubic meters annually, there should be a decided profit after taking into account the cost of concentration. I am prepared, in conjunction with Messrs. Kunheim & Co., who take the liquor of the Bremen works, to offer proof of this in individual cases.

We have in this works arrangements of this kind with the gas works of Cassel, Wien-Florisdorf, Bielitz, Biala, and Bautzen. The cost of the process of concentration can almost be neglected in the smaller works, since the apparatus is, of necessity, managed by the men already employed upon the works, and since the steam required does not cost much, and the retort can be heated by coke.

The manager at Elbing has ascertained that about 75 kilos of coke are required to work up 1,000 liters of ammonia water, the price of which at the time was 20pf. per 50 kilos. When the coke ash is used in properly constructed burners, the cost is reduced still further, and can often be entirely neglected, since the ash is almost without value. The only thing, then, to be considered is the small amount of lime used. The concentration of the liquor is carried out in the usual ammonia distilling apparatus (patented by Gruneberg and Blum), in which the volatile ammonia is driven over by heat, the combined being liberated by the addition of lime. The united mixed vapor of water and ammonia, which, in the manufacture of ammonium sulphate, would be introduced into the saturating chamber, are simply cooled by water, and thus condensed. This method has the great advantage that no nuisance is created, since no obnoxious vapors are evolved.

As regards this question of the unpleasant vapors which are evolved in the making of ammonium sulphate, Kunath states that he has entirely overcome the difficulty by employing the simple process of condensation. The vapors passing out of the saturating chamber, after going through a tube condenser in order to heat the ammonia water flowing into the column apparatus, is led into an iron cylinder and there condensed by water, which falls through it in a fine shower. The residual gas then passes away under the heating arrangement of the boiler, whilst the water flows away at the bottom. The cylinder is 4 meters high and 0.06 meter wide. The use of this simple apparatus removes every trace of unpleasant fume. The gases are introduced at the top of the cylinder, so that the motion of the water, which is in the same direction, may assist the exit of the gases. A short bent piece of tube is introduced into the cylinder at the entrance in order to impart the proper motion to the gas. The same apparatus has been introduced at the works at Thorn, and has there proved equally successful. At Berlin it is the custom to first of all cool the gases, and then to pass them through a purifier containing oxide of iron in order to remove the sulphureted hydrogen. The gases are then led off to the chimney, and are burned, so that all annoyance is avoided.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE American Gas Engine Company, of Bordentown, N. J., has been incorporated with a capital of $500,000. The incorporators are Harry B. Goodwin and Robert C. Hutchinson, of Bordentown ; W. K. Park, of Philadelphia ; C. E. Judson and J. E. Fuller, of Chicago ; C. F. Floyd and O. N. Guldlin, of Fort Wayne, Ind.; and G. W. Lloyd, of Detroit, Mich.

A CONTRACT for the public lighting of Lockport, N. Y., to run for three years, has been awarded to the Lockport Gas Light Company. The Company agrees to maintain 1,200 candle power arcs on the basis of a payment of $72 per annum each, moon-table; gas lamps to cost $18.50 each, also on moon-table schedule.

MR. JOHN CABOT, writing to the JOURNAL under date of Feb. 3, says : "* * * It looks as if the worst of the dull times in the gas business had passed. My business is a pretty good index of what gas companies are doing, and inquiries and orders are coming in since the opening of the New Year in a much more lively manner. Last year I sold trays to something over 100 different companies, this being less than usual. Very little new work is being put in, but the prospect now is decidedly brighter." All of which goes to show that "John Cabot's Trays for Gas Works" still command the market.

SOME time ago we reported the death of Mr. A. Pierce, proprietor of the Oroville (Cal.) gas works. By his will, which was recently filed for probate in San Francisco, and which disposes of property valued at $160,000, he bequeaths the Oroville gas works to Messrs. A. C. Bingham and D. E. Knight, of Marysville, Cal., and James Havey, of Oroville. Of the legatees, the last named has been Superintendent of the Oroville works for many years.

THE Grosvenor-Dale Company, of Grosvenor-Dale, Conn., is building its new coal sheds of iron. The construction is designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and is so arranged that the coal can be unloaded direct from the cars into the pockets without handling. The Grosvenor-Dale Company expects to save a large amount of money each year by doing away with the expense of handling its coal a second time.

THE Rochester (N.Y.) Gas and Electric Company has declared a dividend of 3 per cent. on its preferred stock.

ACCORDING to the report made by the Cleveland (Ohio) Gas Light and Coke Company to the City Auditor it is shown that the quantity of gas sold by the Company for the six months ended December 31, 1893, was 343,723,500 cubic feet. At 80 cents per 1,000 cubic feet the gross income was $274,982.80, of which 6½ per cent. goes to the treasurer, to be charged to the credit of the fund for the new city hall.

ON the 1st instant, Mr. Schanz introduced in the Select Council of Philadelphia a resolution of request to the City Solicitor to inform Coun-

cils as to the right of the city to lay mains and pipes in the district covered by the Northern Liberties Gas Company. This resolution was referred to the Committee on Gas. In connection with the same matter Mr. Schanz introduced a bill authorizing the purchase by the city of the Northern Liberties Gas Company, which bill was also referred.

THE offices of the Consumers Gas Company, of Newburg, N.Y., are now in perfect order, having been handsomely refitted throughout.

THE proprietors of the Hanover (N.H.) Gas Company have reduced the selling rate to $1.50 per 1,000 cubic feet.

THE city gas ordinances of Buffalo, N.Y., have been amended to the point of insisting that hereafter the tests for illuminating power and purity of the gas supplied shall be made monthly.

THE electric lamps in the Board of Education Building, at Columbus, Ohio, have been removed, and the lighting will hereafter be done by gas. It was determined that the electric lighting was carried on at too high a cost.

IT is more than likely that the gas and electric lighting interests of Lawrenceburgh, Ind., will be consolidated.

THE St. Paul (Minn.) Gas Light Company has filed a certificate of alteration of certain powers and organization whereby the capital stock is reduced from $2,500,000 to $1,500,00, the number of shares from 50,000 to 15,000, and the par value per share raised from $50 to $100.

THE following is from the annual report of the Massachusetts Inspector of Gas Meters and Illuminating Gas—Mr. Charles D. Jenkins—for the year 1893: "Major Chas. W. Hinman having resigned from the office of Inspector of Gas and Gas Meters the latter part of April, the former assistant inspector was appointed to fill the vacancy; this necessitated the appointment of a new assistant inspector, who was not ready for work before the last of August. Owing to these changes nothing more has been attempted than to finish the routine work laid out at the beginning of the year, and this report gives the results obtained during the 12 months. During the year 1893 there were inspected 19,706 dry gas meters; of this number 19,175 were new or repaired, while 531 were meters re inspected on the complaint of a consumer or a Gas Company. As the law requires that meters used to supply gas to consumers shall be duly stamped and sealed, all new meters, or those which have been repaired, passing inspection, bear a brass badge soldered on one corner of the top and the date impressed in sealing wax on the opposite corner. The badge and date are put on the meter in such a way as to cover the joint made by soldering on the top of the meter. In order to change the registering mechanism it is necessary to take off the top, and in doing so the date and badge are either mutilated or destroyed; the meter must then be inspected and sealed again before being used. In inspecting the accuracy of registration especial attention is paid to temperature; as a difference of 5° F. makes a difference of about 1 per cent. in the volume of a gas, it is necessary to keep the meter to be tested, the air in the meter prover, the water in the prover tank, and the air in the room, at nearly the same temperature, a difference greater than 3 or 4° not being allowable. When tested under these conditions, at the legal rate of 6 feet per hour for each light the meter is marked to supply, those meters are marked as correct which register within the limits of 2 per cent. The badges are numbered serially, and a record is kept of the proof of each meter, the size in lights, the date of inspection and the maker's name and number. Meters in use are subject to re-inspection by the State Inspector on complaint of a consumer or a gas company; notice is taken as to whether the condition of the badge and seal indicate any alteration of the rate of registration. Of this class there were 531 meters tested last year. The results given below would indicate that more attention should be given by many of the gas companies to the frequent testing of the consumers' meters, and more especially to setting meters in proper places. Meters set in dry places, where the temperature is moderate and equable, need attention in perhaps only 5 or 6 years, and will generally remain accurate much longer; but if the places chosen are near or over furnaces or steam boilers or other unsuitable places, more frequent examination is necessary. The quality of the gas supplied through the meter has an important bearing also. A large percentage of ammonia or unfixed oily vapor may affect the registration by combining with the oil used to render the leather diaphragms soft and pliable and also by corroding the moving metal parts. Sulphureted hydrogen and tarry matter in the gas tend to make the meter work hard. Of the 531 meters reinspected, 3 would not register; 1 varied from 4 per cent. fast to 18 per cent. slow; of the remaining 527, 284 or 53.9 per cent. were correct, within the 2 per cent. limit, and were sealed and stamped anew; 197, or 37.4 per cent. were fast, registering against the consumer, the average error being 5.1 per cent.; 46, or 8.7 per cent. were slow, the average error being 9.3 per cent. The average error of the 527 meters tested was 1.23 per cent. fast. Excepting for the year 1875, this is the highest average per cent. fast for 20 years. Of the 197 fast meters, 86 were 5 or more per cent. fast; 17 were 10 or more per cent. fast; two were 22, two were 17, one 15 and two 14 per cent. fast. Of the 46 slow meters, 26 were 5 or more per cent. slow, and 8 ten and more per cent. slow; the slowest meter was 83 per cent. slow, one was 50, one 30, two 20, and one 18 per cent. slow. Eight gas meter provers have been graduated the past year by means of the standard cubic foot. The law provides that the gas of every company, supplying more than 50 consumers shall be tested at least twice a year, an additional inspection being made for every six million cubic feet of gas supplied by it. The candle power given by burning the gas at the rate of 5 feet per hour through the burner best adapted to it must not be less than 16, the standard being the standard English sperm candles, burning at the rate of 120 grains of sperm per hour. The gas must not contain more than 20 grains of sulphur or 10 grains of ammonia per 100 cubic feet of gas, nor any sulphureted hydrogen. In testing the gas supplied by the 68 companies, the examinations were made at irregular intervals, without any notice whatever to the gas companies, following the consumption to an extent by making more tests in the winter than the summer. The gas of the coal gas companies was tested with the Sugg London argand burner, size "D.;" the water gas with an open burner, generally the 6 feet size, Sugg's Table Top, and the mixed coal and water gas with the argand. The sulphur was determined by burning a known quantity of gas in an ammoniacal atmosphere and determining the sulphuric acid found, volumetrically. The ammonia was found by a calorimetric method. The gas being passed through an amount of standardized hydrochloric acid equivalent to .01 of a grain of ammonia gas, with cochineal for an indicator, the change in color showed the point of neutralization of the acid. Sulphureted hydrogen was looked for when setting up the sulphur apparatus. Only three eudiometric analyses have been made the past year, and a few specific gravity determinations have been made." The Inspector then follows with a number of tables showing the illuminating value and purity of the gases supplied by the different Companies throughout the State. From these it is seen that the Boston Company leads in point of the illuminating value of the gas distributed by it, although the range is somewhat elastic. During the year 52 inspections of the Boston Company's gas were made, the average of same showing 24.83 candles. The maximum test showed 27.7 candles, and the minimum is returned at 19.9 candles. The lowest average illuminating power of the 24 large Companies is charged to Cambridge Company, or 16.99 candles, although the range was much more even than that charged to many other Companies, the average of which is given at higher figures. Of the Cambridge gas 24 inspections were made, the highest return being 17.5 candles and the lowest 16.2 candles. Of the Companies making oil gas (10 in number) the highest average candle power is attributed to the Gardner Company, the product of which is returned at 51.90 candles, and the lowest average to the Southbridge Company, which is placed at 24.73 candles. The general average for the oil gas companies is 33.42 candles. Continuing, the Inspector says: "Leaving out the oil gas companies, the average candle power for the State was 18.92; for the 40 coal gas companies the average was 18.86, an increase of 0.26 of a candle over last year. For the larger companies there was an increase in candle power of 0.43, and for the smaller companies an increase of 0.54 of a candle, both being due largely to the higher candle power of the water gases, although many of the coal gases were improved somewhat. The decrease in sulphur is probably due to a better quality of coal being furnished last year. At Lowell the Gas Company has added apparatus for making water gas, the two gases being supplied mixed. The Brookline Gas Company changed from coal to water gas, two tests being made after the water gas apparatus was in use, 23.8 and 24 being the candle powers obtained. The gas at Danvers on March 25 gave a candle power of only 15.8; at Westfield and North Adams, on December 13, the candle powers were 15.3 and 15.9. Salem had the fourth low candle power, 15.4, on December 28. After the legal standard for candle power was raised in March, 1892, from 15 to 16, some criticism was made by the gas companies that it was too high, but it would seem to the Inspector that 16 is fully low enough. Excepting, perhaps, Danvers, the companies above noted as being deficient in candle power usually furnish much better gas, as shown by their averages; and the last three companies owe their deficiencies to temporary trou-

bles. Of the 40 companies furnishing coal gas, which is naturally lower in candle power than the water or oil gases, the average was a candle power .86 above the legal requirements, and but 3 averaged below 17 candles."

THE United Light Company, of Uniontown, Pa., has declared and paid its semi-annual dividend of 4 per cent.

THE offices of the Woburn (Mass.) Gas Company have been removed to the Dow Block, a change that will be greatly appreciated by its patrons.

IN connection with the report that it was proposed to construct a gas works at Newport News, Va., we may mention that a bill for this purpose has been introduced in the Virginia Legislature. The name of the Company is that of the Peninsula Gas Company, and its incorporators are A. C. Jones, George B. West and L. P. Stearnes, of Newport News; David E. Flemming, of Washington, D. C.; W. A. Little, of Fredericksburg, Va., and Fred. S Benson, of Brooklyn, N.Y. The charter also grants the Company the right to do business in the town of Hamilton, but the understanding is that Newport News will be the starting point of its operations.

THE understanding now is that the syndicate organized for the purpose of taking over the plant and franchises of the Grand Rapids (Mich.) Gas Company have purchased the properties at the price of $200 per share, which means an investment of $1,200,000.

POLICE JUSTICE STUBBS recently decided that the Indianapolis Gas Company had violated the ordinance regulating the sale of natural gas in that city, and fined the Company $25 and costs. The case was brought by Thaddeus Curry, who claimed that the Company violated the ordinance by charging him $2 per month for a No. 7 cook stove, whereas the rate under the ordinance was only $1.25. The Company, on Curry's refusal to pay the amount charged, cut off his gas supply. Judge Stubbs holds that the action of the Company is in direct violation of the ordinance, as the latter does not specify how much gas is to be used or how many rooms are to be heated, and asserts that the Company has no more right to charge over the specified rates for several rooms than it has to charge over rates on a single stove because of the number of members in the family who used it. In concluding he states that the action of the Company is contrary to the intention of the framers of the ordinance, as well as the letter of it, for it specifies very clearly how charges shall be made. The defence made by the Company was that Curry was using the cooking stove as a means of heating his apartments, instead of employing it solely for cooking purposes, as the contract implied when the stove was placed. The Company has lodged an appeal.

THE San Francisco Gas Company has imported six dozen prepayment gas meters, of the W. & B. Cowan type, adjusted to pass 125 cubic feet of gas for every coin of the denomination of 25 cents "dropped in the slot."

A FEW days ago the works of the Citizens Gas Light Company, Brooklyn, N.Y., were jeopardized by an explosion of naphtha in a 40,000 gallon tank, which contained about 25,000 gallons at the time of the outbreak. Careful and energetic work on the part of the firemen kept the flames within bounds. Damage about $1,200.

MR. JOHN A. BRITTON, Secretary of the Oakland (Cal.) Gas, Light and Heat Company, announces that a branch office has been opened in the adjoining district of Alameda, at the northwest corner of Park street and Railroad avenue, for the convenience of consumers in that section. The office is in charge of Mr. Thomas A. Smith, as resident agent, and he is authorized to receive all moneys due the Company and to attend to all orders and complaints. A complete assortment of gas cookers, heaters, etc., will be kept on show in the Alameda branch.

OUR readers will remember the charges recently made by a local newspaper in San Francisco to the effect that the Gas Company had swindled the city by putting burners on the street lamps which passed less than the 5 cubic feet per hour stipulated in the contract, and our readers will also remember President Crockett's specific and indignant denial of the charge. Ample and complete vindication came to the Company a few days ago in the report furnished the authorities on the charged substitution, by the City Gas Inspector, Mr. Gannon, who was instructed to investigate the passing capacity of the burners in use, such tests to be made without the knowledge of the Gas Company. The Inspector selected burners from 12 lamp posts in widely separated sections of the city, and the average consumption per hour was shown to be 5.39 cubic feet. No single burner showed a consumption of less than 5 cubic feet per hour.

THE San Francisco Gas Regulating Company has been incorporated with a capital of $100,000, by Messrs. George H. Waggoner, L. E. Lee, W. E. H. Williams, Jas. A. McCorkell and B. F. Lee, all of San Francisco.

SOME days ago two shares in the New Bedford (Mass.) Gas and Edison Light Company were sold at the rate of $121.25.

AT the annual meeting of the Marblehead (Mass.) Gas and Electric Light Company, Mr. W. Eliot Fette was re-elected President.

AT a meeting of the Franklin Gas and Electric Light Company, of Franklin Falls, N. H., the Hon. A.W. Sulloway was elected President, to fill the vacancy occasioned by the death of the Hon. Walter Aiken.

ON the 1st inst. the employees of the York Light, Heat and Power Company, of Biddeford, Me., were notified of a 10 per cent. reduction in their wages, the cut to affect all the employees of the Company.

THE Lewistown (Pa.) Electric Light Company has purchased the Lewistown gas works. The price paid is said to have been $10,000.

THE following notice was recently issued by the Cumberland (Md.) Gas Light Company: "The collection office of the Company has been removed from No. 9 South Liberty street to the general offices of the Company, 134 Mechanic street, and the following changes have been made in the time for payment of bills: The customary discount will be allowed on all bills paid before the 10th of each month. No discount will be allowed after that date, and the gas will be shut off from consumers who have not paid by the 20th of the month following the one for which the bill is rendered. Formerly this was not done until after the 30th of the month. Consumers will please note this change and be prepared to pay the collector on his first call."

THE bid submitted by the Citizens Gas Light Company for the public lighting of East Orange, N. J., was as follows: For a period of 5 years, each lamp to burn 3,600 hours per annum, $19 per lamp per year. The Company agrees to extend the lighting system through all the streets of the township, $20 to be paid for each new lamp put in; to furnish gas to public buildings at $1.40 per 1,000 cubic feet; to keep the 10 large Bray burner lamps burning free of cost; and to put double burners in all of the Main street lamps and on corner lamps throughout the town.

AT the annnal meeting of the stockholders of the Westfield (Mass.) Gas Light Company the following officers were chosen: Directors, L. R. Norton, W. F. Thayer, E. B. Gillett, C. N. Yeamans, Herbert Lyman, Marvin Chapin and S. J. Fowler; President, L. R. Norton; Clerk and Treasurer, W. F. Thayer.

THE eighth fire in the history of the Spencer, Mass., Gas Company occurred a few days ago. The damage was not considerable, which fact is largely attributable to the iron roof recently placed over the generating house.

THE proprietors of the Geneva (N. Y.) Gas Company are greatly pleased over the increase in gas consumption since the reduced rates went into effect.

A CORRESPONDENT at Buffalo writes: "I failed to see anything in the JOURNAL regarding the first general meeting of the Consumers Gas Company, of Montreal, which took place towards the close of January. The meeting was very harmonious, and the following officers were chosen: Directors, John Coats, C.E., A. F. Gault, Charles Magee, Robert Blackburn and Richard White; President, John Coats, C.E.; Vice-President, A. F. Gault."

THE Atchison (Kas.) Gas and Electric Light Company reports a steadily increasing business in both departments.

THE Committee on Lamps and Gas, of the Brooklyn (N. Y.) City Council, have rejected the bids submitted under the original call for proposals for arc lighting, on the ground that the named prices (39 cents for 1,200 candle power lamps) were too high. The reform Mayor, Mr. Schieren, thinks that 35 cents is sufficient, and in support of his belief points to the New York rates. The Mayor, however, forgets to add that the New York electric companies, with the exception of the Edison Company, are all in a bad way.

The Market for Gas Securities.

Consolidated opened at higher prices to day (Friday), 125 being bid, with no stock offering. The trading in it has been light all along, and there is an unmistakable tendency to mark the shares down on every possible occasion, but a *bona fide* inquiry for anything like a round lot invariably sends the rate up a couple of points. The strength of the stock is rather remarkable in view of the bills before the Legislature seeking to put the gas rate in New York at $1 per 1,000; but somehow or other the idea is gradually gaining ground that the bills will not pass. Other city shares are steady.

In Brooklyn shares nothing is doing, but the current market quotations indicate a shrinkage in values. It is reported that the Court of Appeals has sustained the validity of the charter of the Equity Company, but this should cut no especial figure, since it has been held all along by the best posted men that the Equity was all right in so far as the continuity of its charter was concerned. The gas business in Brooklyn for the past six months has been slow, and there does not seem to be any immediate prospect of its betterment. Chicago gas, on the reported passage of the Metropolitan-Watson gas ordinance, sold below 63, but recovered somewhat, having opened to-day at 64. Baltimore Consolidated is strong, at 57 to 58, and Bay State is listless at 15. Consumers, of Jersey City, has reappeared in the quotations, and is bid for at 27, which is a queer commentary on changes in values.

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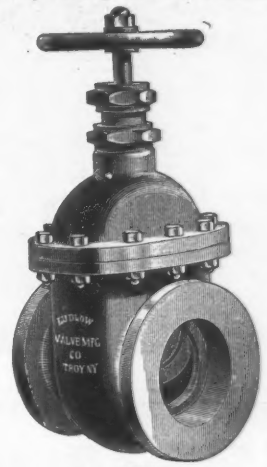

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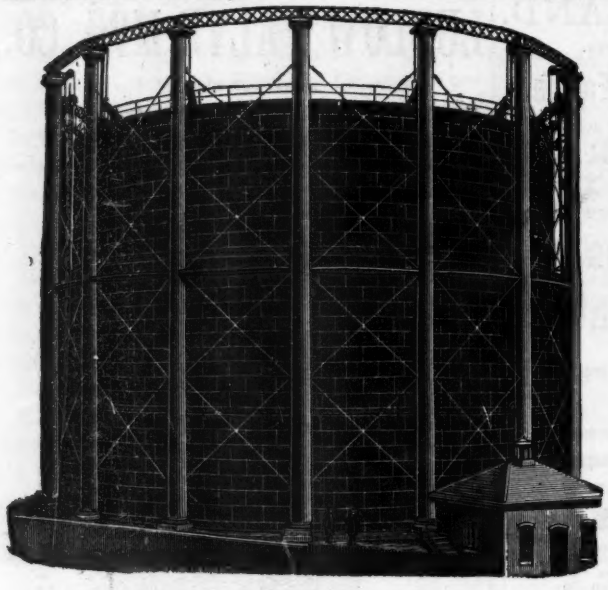

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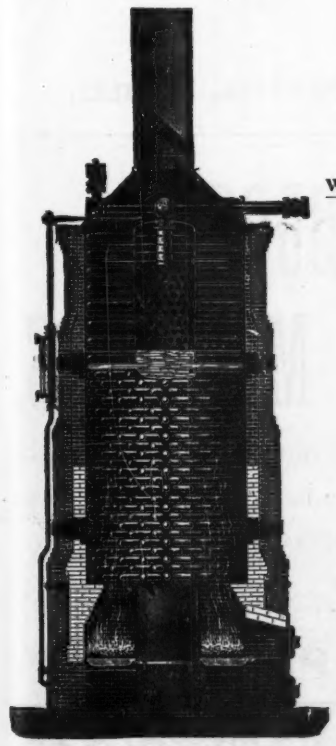

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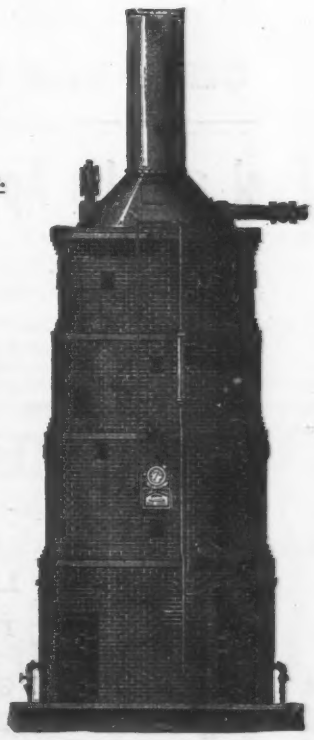

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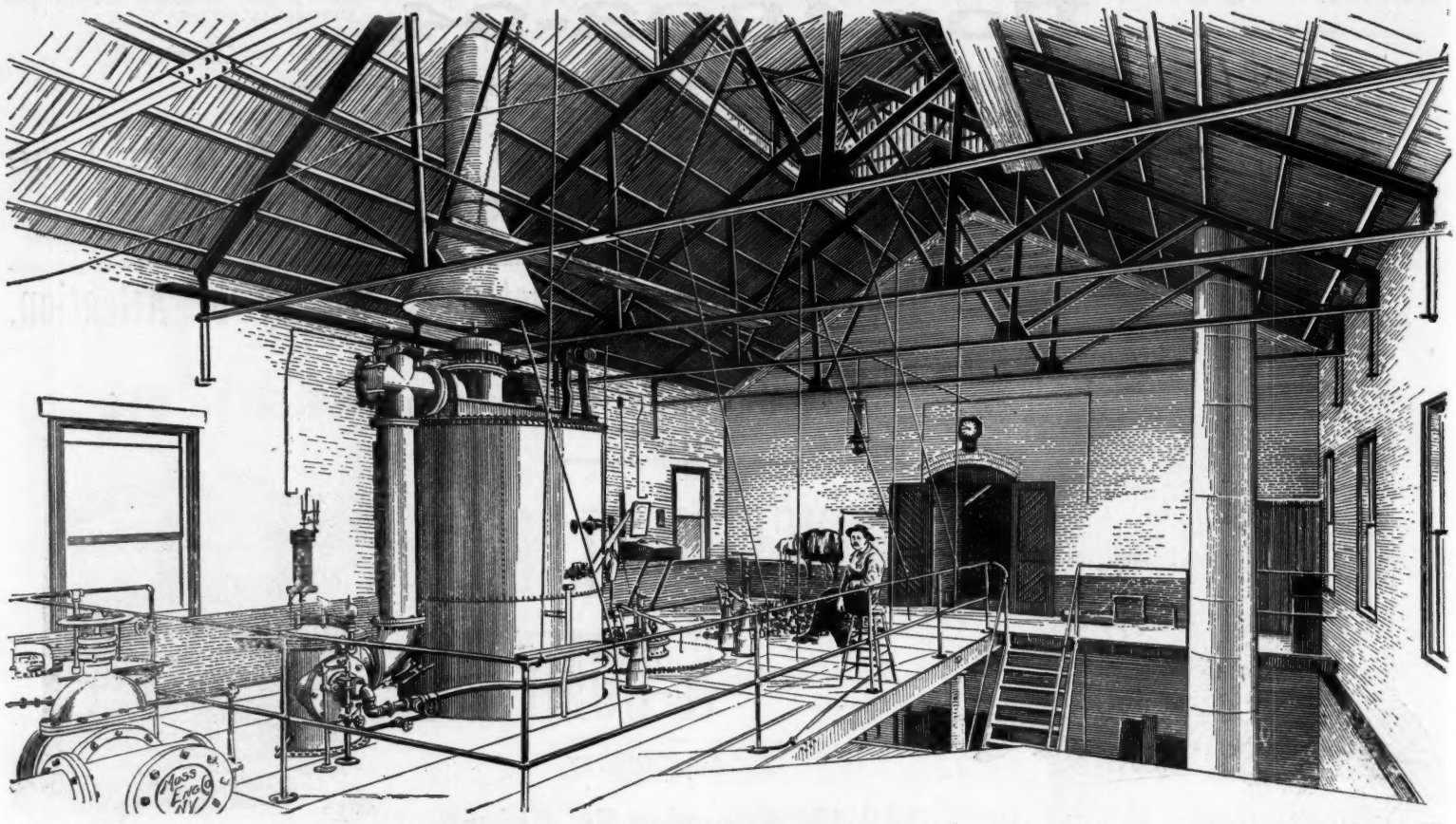

The above illustration is taken from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof on this building was furnished by us. The building is 32 feet in width by 50 feet in length, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated shutters on each side opening and closing by cords from the floor.

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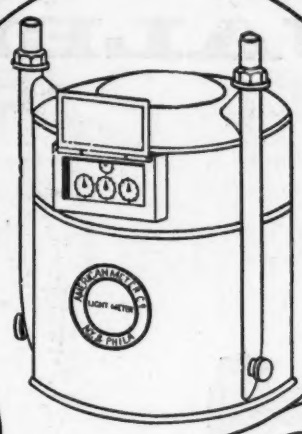

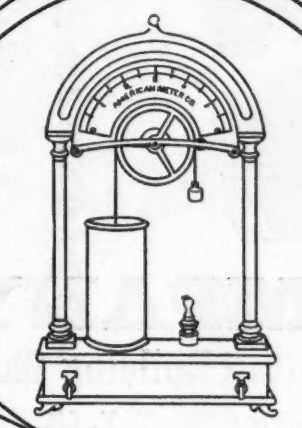

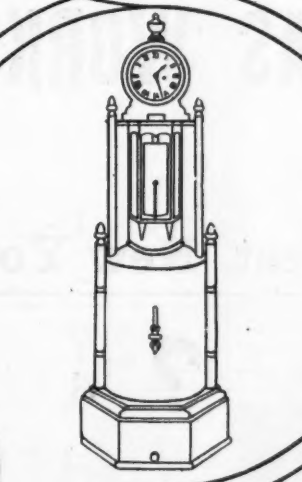

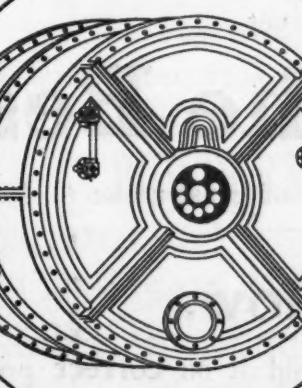

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ST. LOUIS, SAN FRANCISCO.

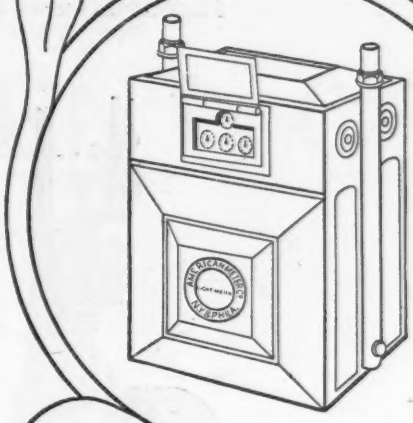
PUBLIC LIGHTING TABLE.

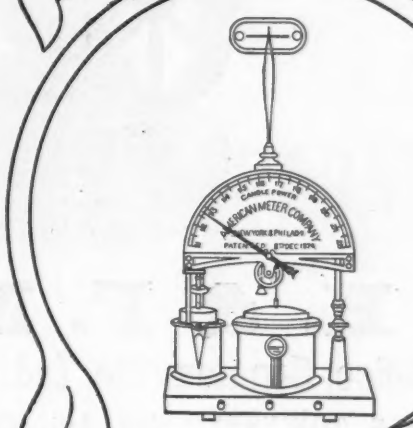
FEBRUARY, 1894.

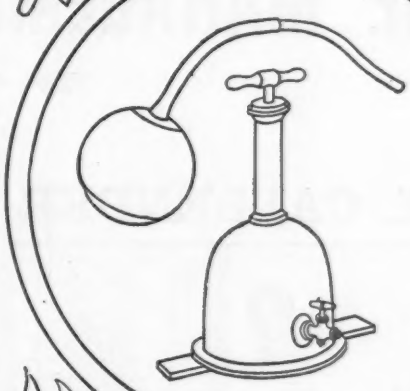
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	5.50 PM	6.10 AM	5.05	6.15
Fri.	2	5.50	6.10	5.05	6.15
Sat.	3	5.50	6.10	5.05	6.15
Sun.	4	5.50	6.10	5.05	6.15
Mon.	5	5.50 NM	6.10	5.10	6.10
Tue.	6	5.50	6.00	5.10	6.10
Wed.	7	6.00	6.00	5.10	6.10
Thu.	8	6.00	6.00	5.10	6.10
Fri.	9	6.00	6.00	5.10	6.10
Sat.	10	9.40	6.00	5.10	6.10
Sun.	11	10.40	6.00	5.10	6.10
Mon.	12	12.00	6.00	5.20	5.55
Tue.	13	1.10 AM FQ	6.00	5.20	5.55
Wed.	14	2.20	5.50	5.20	5.55
Thu.	15	3.30	5.50	5.20	5.55
Fri.	16	4.30	5.50	5.20	5.55
Sat.	17	No L.	No L.	5.20	5.55
Sun.	18	No L.	No L.	5.20	5.55
Mon.	19	No L. FM	No L.	5.30	5.55
Tue.	20	6.10 PM	7.30 PM	5.30	5.55
Wed.	21	6.10	8.40	5.30	5.55
Thu.	22	6.10	9.50	5.30	5.55
Fri.	23	6.10	11.00	5.30	5.55
Sat.	24	6.20	12.10 AM	5.30	5.55
Sun.	25	6.20	1.10	5.30	5.55
Mon.	26	6.20	2.20	5.30	5.45
Tue.	27	6.20 LQ	3.20	5.30	5.45
Wed.	28	6.20	4.10	5.30	5.45

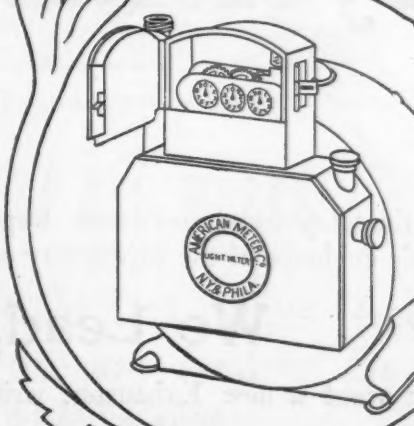
TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45









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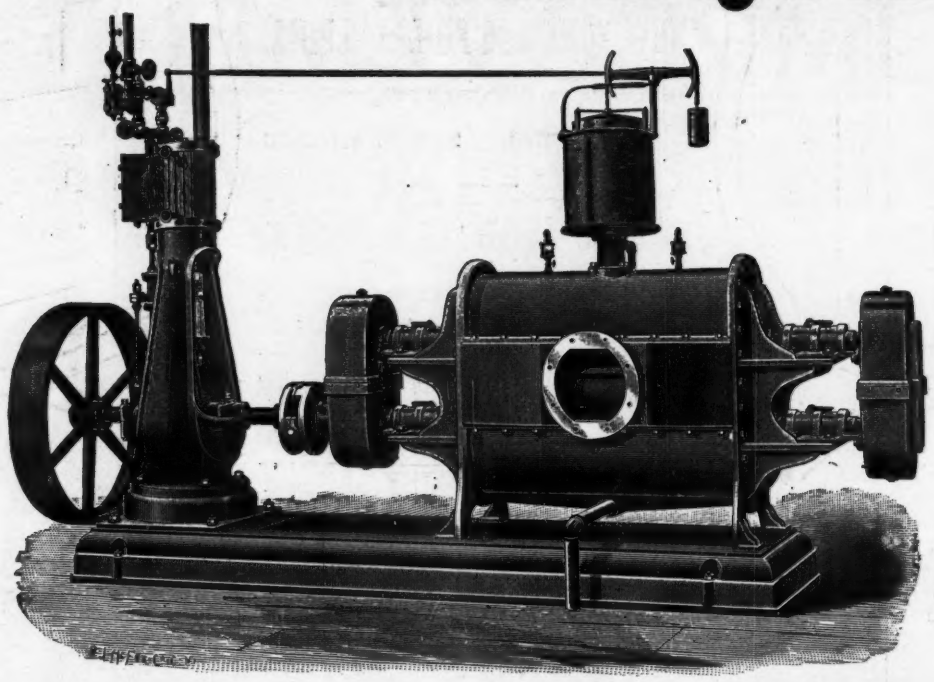

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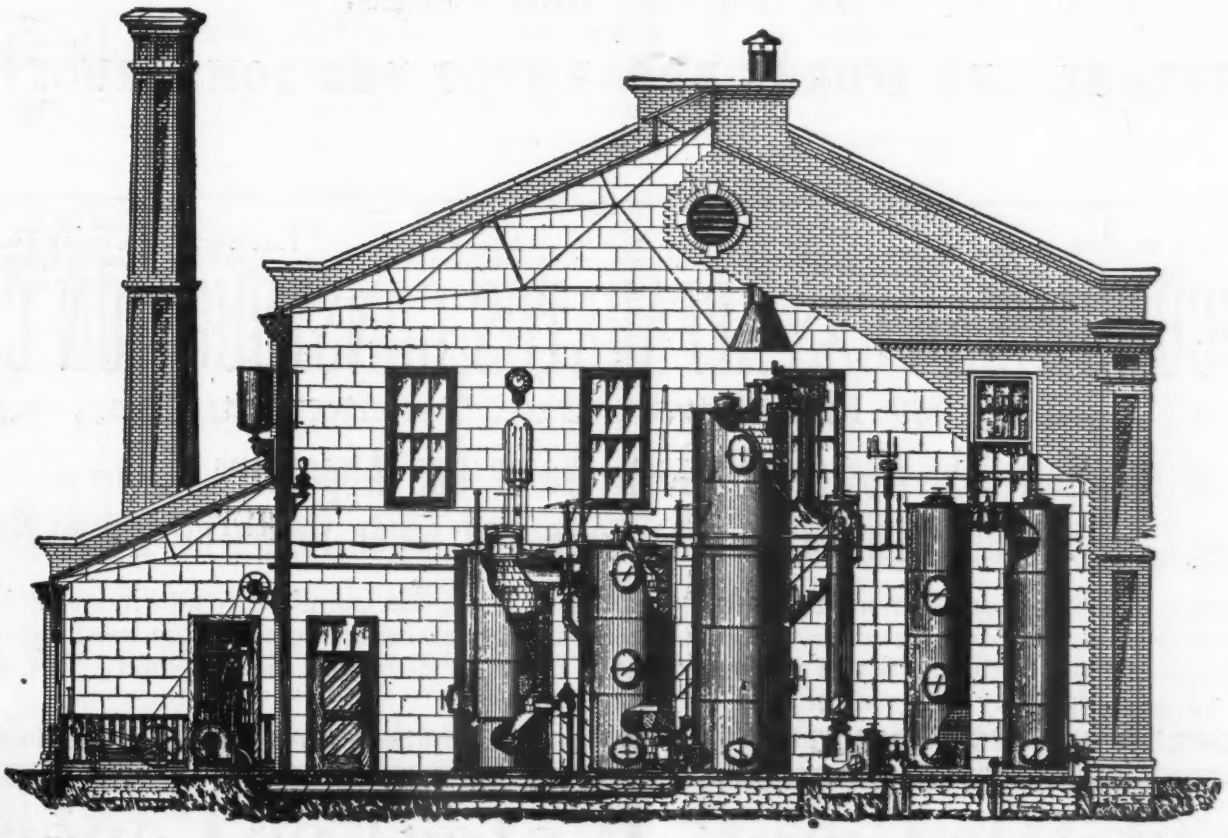

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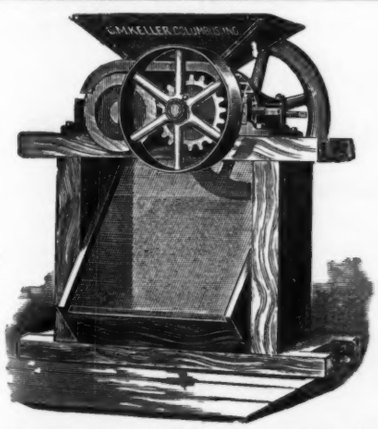

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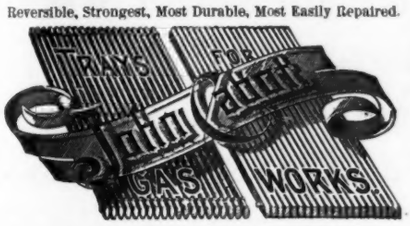

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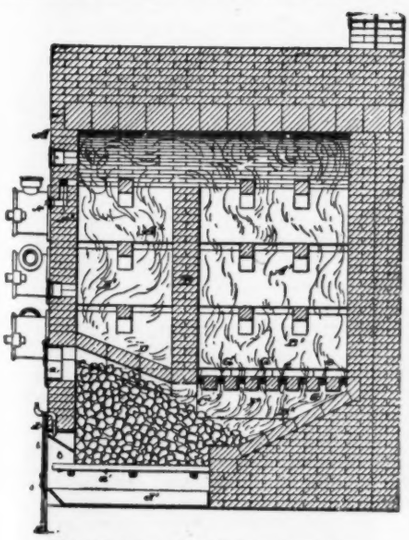

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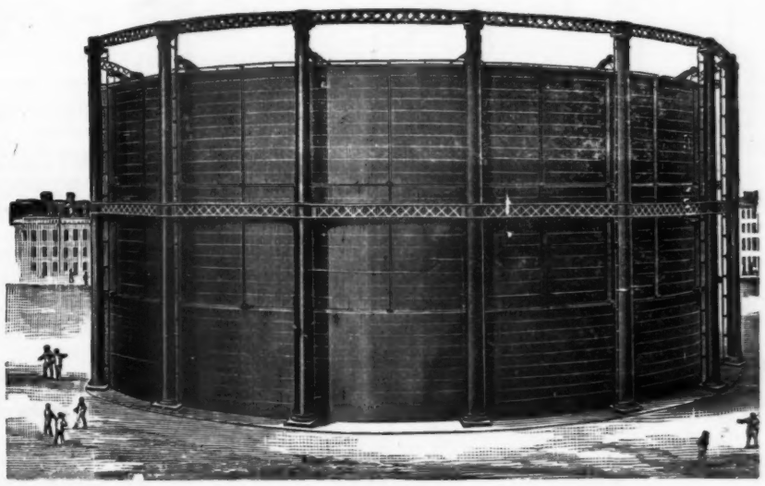

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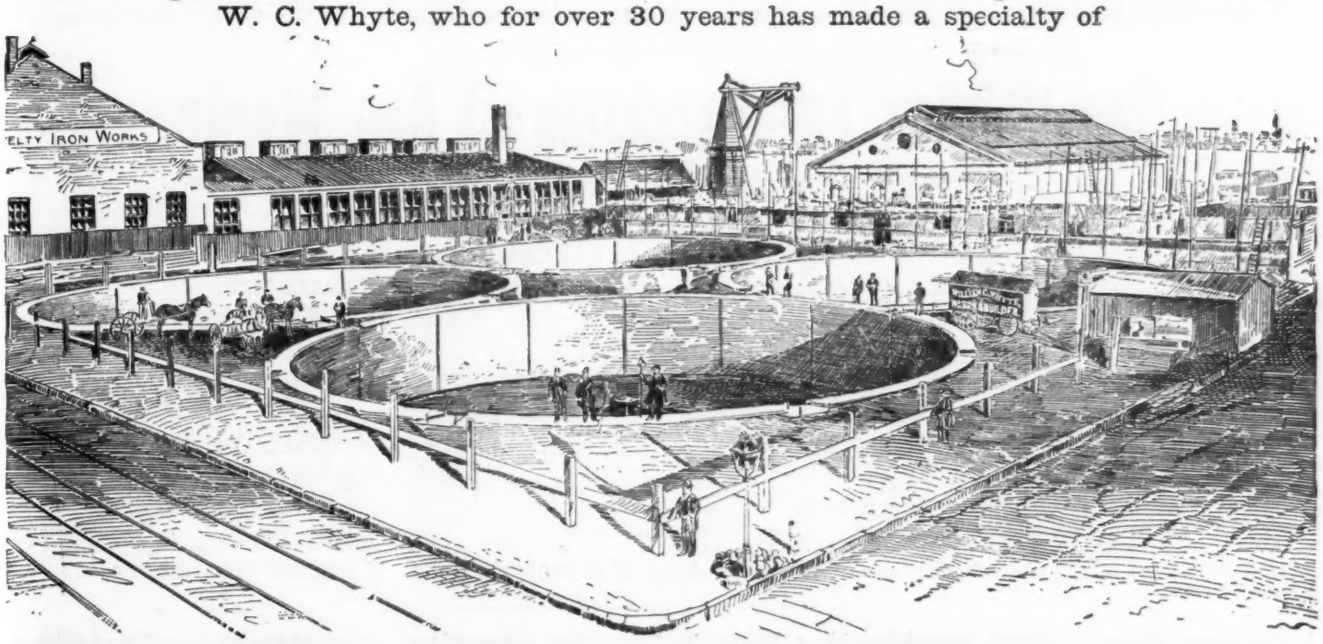

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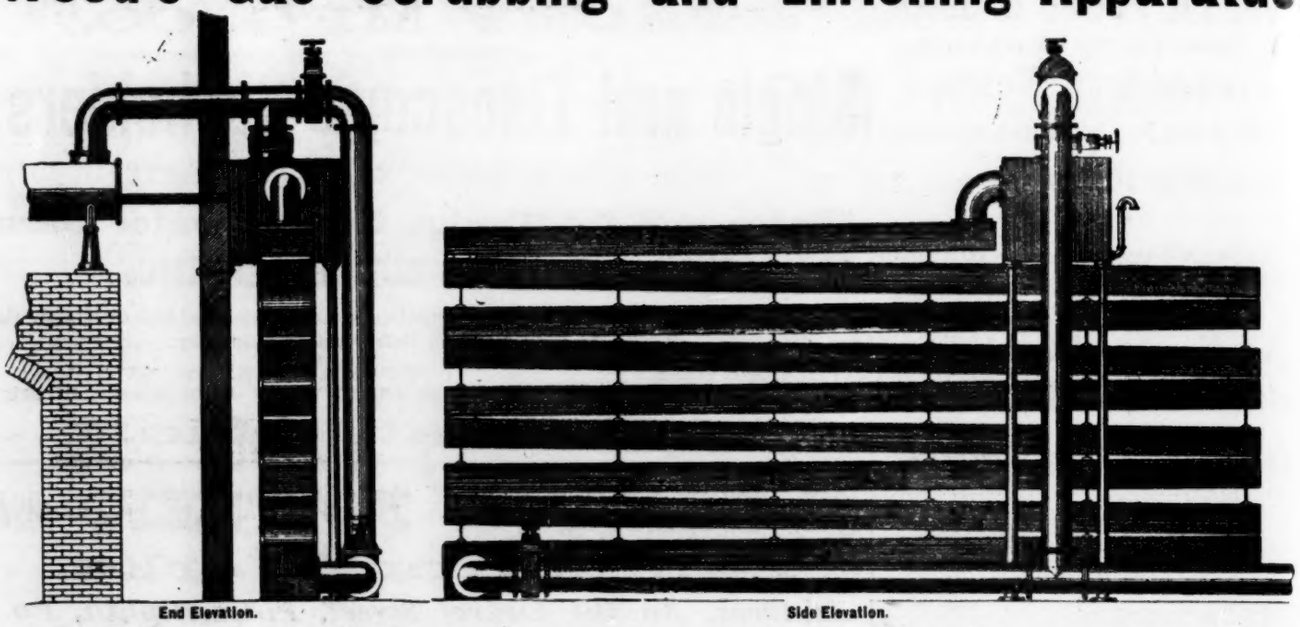

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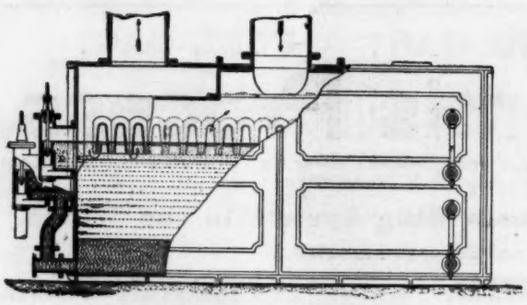

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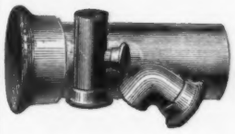

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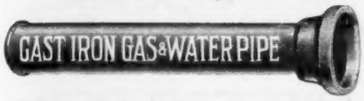

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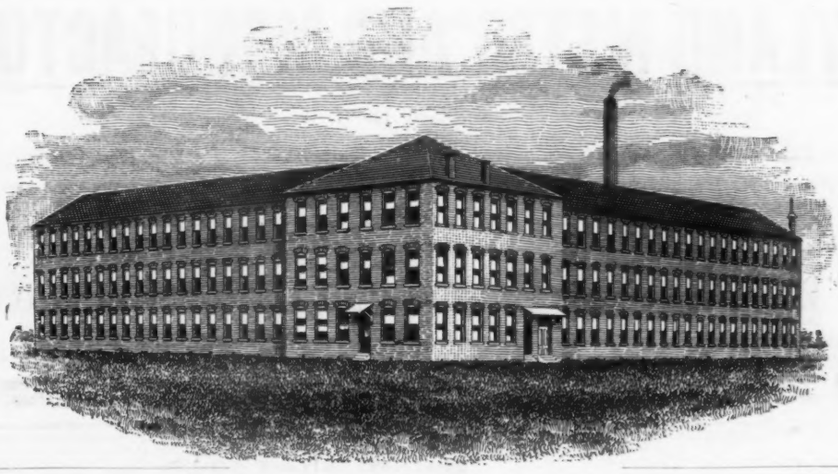

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